American Machinist
Volume 58 NEW YORK, MARCH 22, 1923 Number 12

Controlling Costs in Building Experimental Machines

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Editor, *American Machinist*

The first of three articles—A method that saves expensive shop work, prepares for future manufacture, and shows and controls costs at all times

WHILE millions of dollars are being spent every year for the development of new machines and devices, the opinion prevails that no efficiency methods can be used during the developing stage. Yet that is what has been not only attempted, but accomplished, by C. Gehring, the mainspring of the Mechanical Efficiency Co., Akron, Ohio, and Newark, N. J.

Perhaps the most interesting point about the system to be described is that it is altogether different from any other system. It controls costs on the first machine built, both by regulating design and method of building; it prepares the shop for the manufacture of future machines within a reasonable time, and at a known cost; it records the cost of each part and assembly, and does it all with a minimum of clerical assistance.

The usual method is to design a mechanism which will work, almost regardless of its cost, and then reduce the expense by simplification in future machines. Such a method has the great disadvantage of requiring much redesigning of the machine itself, of designing and making tools and fixtures, and of delaying ultimate production. Furthermore, it leaves the question as to what the machine will cost to be determined at some future time. And, worst of all perhaps, the very lack of knowledge as to costs makes it impossible to set selling prices intelligently, which in turn delays the securing

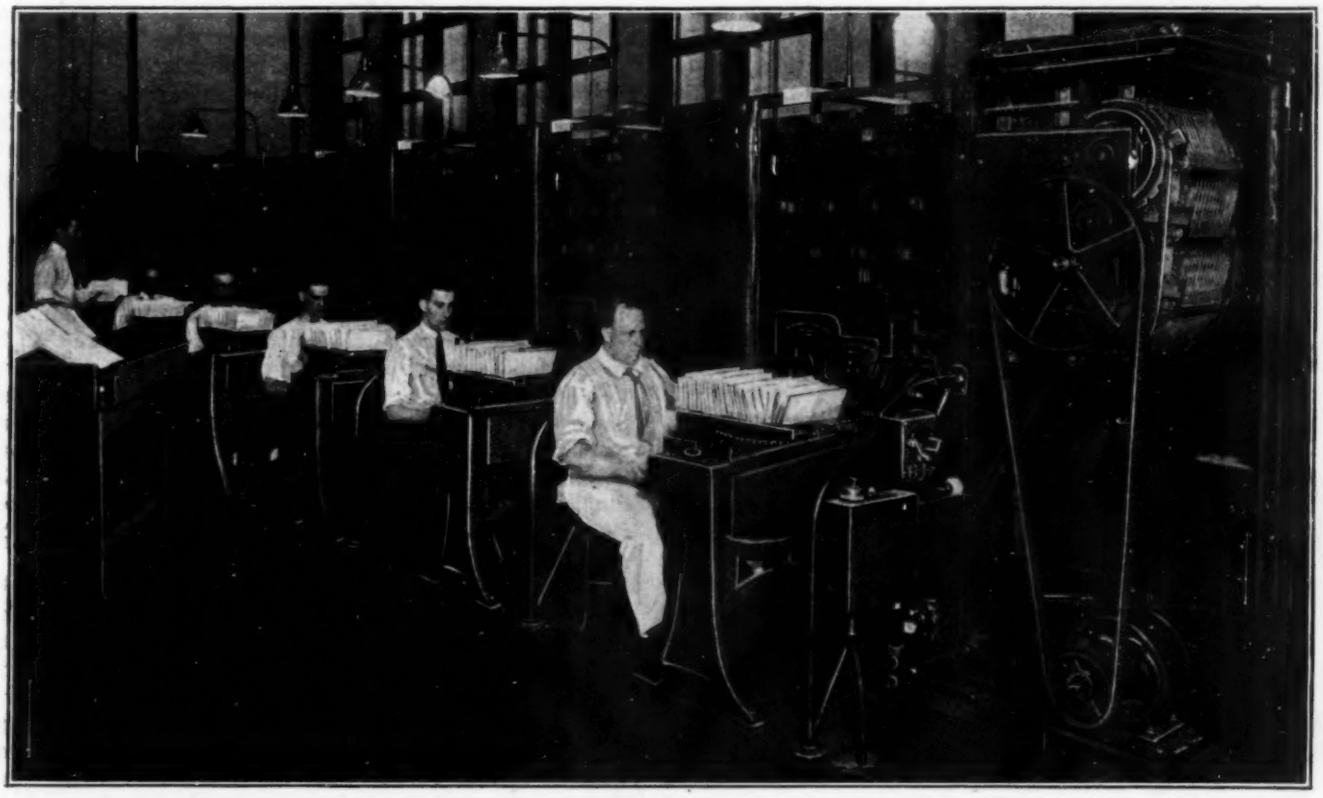


FIG. 1—GENERAL VIEW OF MAIL SORTING MACHINE

of the orders necessary to start production. It is a sort of vicious train which retards development in every way.

The problem was to design and build a new model of a mail distributing machine that was tested a few years ago in the Chicago Postoffice. The new model consists of two essential sections, five independent keyboards, and 165 carriers, forming an endless chain which travels over three rows of superimposed boxes mounted on a frame of structural steel.

The illustration of this machine, Fig. 1, gives some idea of the problems involved. Each of the five keyboards accommodates an operator who reads the address on the front letter and strikes the proper key, the machine automatically conveying the letter to the proper box. After the key is pressed, the letter passes through the separating mechanism and enters a loader, which is put into operation by the first empty carrier that passes. The loading mechanism, by a semi-circular movement, automatically sweeps the letter into an empty carrier and closes its door. Each carrier is provided with a selecting device, on which a combination is automatically set, corresponding to the key pressed by the operator, thus determining the box to which the letter is delivered. Each box has a stripping mechanism operated by the carrier itself, which interposes an obstruction in the path of the letter, opening the door of the carrier, and thereby strips this letter into the proper box. To appreciate the mechanical difficulties involved in the production of this machine, it must be remembered that only a perfect performance can be tolerated. A very few failures to properly sort the mail would condemn the entire machine.

SPECIFICATIONS OF A FIVE OPERATOR MAIL DISTRIBUTING MACHINE

MODEL "A"
NO OF TIERS.....3
NO. OF SEPARATIONS-120

UNITS		1 NO.1,000 FEED TABLE	2 NO.2,000 KEYBOARD	3 NO.3,000 CONTROL	4 NO.4,000 SEPARATOR	5 NO.9,912 KEYBOARD MACHASSEM	6 NO.5,000 LOADER	7 NO.6,000 BUTTON SETTER	8 NO.7,000 CONVEYOR PROPER	9 NO.8,500 ELECTRICAL EQUIPMENT	10 NO.9,000 BUTTON BOX	11 NO.9,200 CARRIER	12 NO.9,500 STRIPPER	13 NO.9,914 ASSEM. OF CONV. PROPER	14 NO.9,9000 FINAL ASSEMBLY	15 TOTALS
SCREW MACHINE	INDIVIDUAL	17	75	51	89	60	138	58	64		6	22	20	10	9	609
	TOTAL PTS.	245	1620	356	1560	660	1230	560	1142		1320	4950	2400	440	52	15524
STEEL	INDIVIDUAL	20	67	31	51	26	/	32	94	22	2	6	22	22	58	474
	TOTAL PTS.	140	1525	160	1485	272	/	360	94	325	2970	2640	3615	345	1995	14130
PUNCHINGS	INDIVIDUAL	3	14	/	/	/	1	1	2		9	29	12	2	/	73
	TOTAL PTS.	1860	945	/	/	/	5	5	9		2805	5240	1350	158	/	16377
SPECIAL PURCH.	INDIVIDUAL	3	19	7	103	2	12	2	12	45	2	14	2	9	1	233
	TOTAL PTS.	50	910	40	686	30	65	10	83	162	330	5445	240	29	5	8086
STANDARD PURCH.	INDIVIDUAL	11	30	14	35	26	29	11	40	13	1	5	12	24	18	269
	TOTAL PTS.	300	4635	125	605	358	435	110	1212	395	660	1980	3540	1440	528	15380
CASTINGS	INDIVIDUAL	4	26	6	34	11	27	6	41		/	/	5	1	/	161
	TOTAL PTS.	20	135	30	170	60	145	30	146		/	/	800	5	/	1131
NUMBER OF	ASSEMBLIES					3	1					2		13	2	21
	SUB ASSEM.	6	94	18	94	19	75	19	153		4	23	25	16	29	1575
TOTALS:	INDIVIDUAL PTS	58	251	109	392	125	207	110	253	80	20	76	73	66	87	1909
	TOTAL PTS	2615	6770	710	4435	1377	1880	1155	2686	882	8085	24255	11535	2417	784	69626
SUB ASSEMBLY	INDIVIDUAL	6	94	18	94	19	75	19	153		4	23	25	16	29	575
	TOTAL	50	895	90	535	115	385	190	206		3300	4785	1560	123	56	27290
TOTAL SPECIAL TOOLS		45	200	70	163		181	41	95		58	174	215			12220

FIG. 2—TABLE OF PARTS USED

Limiting the Cost of Machine

Instead of proceeding on the regular lines, Mr. Gehring set an approximate cost on the machine itself and on the units which enter into it. If the design submitted could not be built within the limit set, a new and simplified design was called for. This was not only on account of the cost of the first machine, but so that future costs could be known. Drawings were not traced in ink until they were known to be correct.

When the design was satisfactory, a preliminary estimate was made as to the time required and the work turned over to the experimental department. This might perhaps be called the practical planning department, for from the results so obtained the final operation sheet was made. The experimental or planning work was done by thoroughly experienced men, selected for their knowledge of machines and their ability to plan ways and means of doing intricate and unusual work. These men consult frequently as to methods and tools, and in this way determine the best way of doing the work.

In consultation with them is a sort of roving production foreman who offers suggestions based on the shop equipment and his experience in general work. The tool designer also works in connection with these men, and his designs must be approved both as to production and cost. For it must be remembered that the quantity is very limited until the machine gets into real production.

Before the final tools, fixtures and operation sheets are decided upon, the production foremen look them over so as to know what is to be expected of them, offer objections or suggestions, and in this way prevent friction or misunderstandings later. Thus, all criticisms as to the operation sheet not being practical, or that the time given is impossible, are effectively done away with. The men in the experimental department can prove at any time that they are easily possible. In this way, a standard time is provided for parts of the first machine, more accurately than could be estimated and without the use of stop watches or other devices.

Knowing the Costs

The manager knows his cost from the start, keeps manufacturing costs low considering the nature of the work, paves the way for future machines, and such special tools as are needed, and can get into real production at low cost in a very short time. To be sure, some money is tied up in tools and fixtures, even on the first machine, but only where there are a sufficient number of duplicate parts to warrant it. For, as the same part is duplicated many times, as in some units of the machine, the problem of assembly demands interchangeability even on the first machine built.

Although the first machine used in the Chicago Postoffice was in operation for over eight months, and was approved, the department in Washington asked for a new design of the entire machine in order to make it adaptable for both large and small offices. As the Government had definite ideas as to what it was willing to spend for these machines, regardless of the performance, it became evident that the new model would have to be built at a cost not to exceed this predetermined

amount. It was, of course, realized that the first machine of the new model would cost many times its selling price, and also that, unless the subsequent machines could be built at an economical figure, the investment would become a complete loss. It became necessary, therefore, to do all the preparatory work for the building of future machines while building the first model, as previously mentioned. Time was also an important element and the plan was outlined so as to be able in one year to start production capable of turning out a five-operator machine every six weeks.

This was a proposed production of about 45 keyboards per year and, as many of the parts occur but once, they would have to be built in lots of 45, making it a jobbing shop proposition. On the other hand, a number of the parts occurred many times in the combined mechanism, making it possible to secure them at a comparatively low manufacturing cost. It is interesting to note at this point that each of the keyboards and its part of the conveyor equipment contain from three to four times the amount of work as a standard linotype machine.

Analyzing the Parts Used

The magnitude of the problem can perhaps be best comprehended by a more or less careful study of the table of parts shown in Fig. 2. This table shows a very ingenious method of recapitulating in condensed form, a complete record of the number of individual parts in each unit, the total number of pieces in each unit, the kind of parts, the number of parts in sub-assembly, and the number of special tools for each part.

The column headings show the various units of the machine and the drawing numbers for these units. This means that the drawings for the key table have numbers beginning at 1,000. Drawings for the keyboard begin at 2,000, and so on for the various units. Assembly drawings begin at 9,912 for the keyboard, 9,914 for the conveyor, and 9,900 for the final assembly.

The table is interesting in a number of different ways. Column 1 shows, for example, the number of parts of different kinds used in the feed table; 17 individual screw machine parts, 20 different parts of steel, 3 individual punchings, 3 parts purchased on special orders, 11 parts of standard purchases, and 4 individual castings. The second row indicates a total of 245 screw machine parts, 140 parts of steel, 1,860 punchings, 50 special and 300 standard purchases, and 20 castings. These are all totalled below the double line, which shows 58 individual parts, and 2,615 total parts in each feed table unit. Each unit is composed of 6 individual sub-assemblies, a total of 50 sub-assemblies being used in this unit. The last line shows that 45 special tools were made to be used in manufacturing the table.

The various units shown in columns 1, 2, 3 and 4 are combined to make the keyboard machine assembly shown in Column 5. It will be seen that in addition to the individual parts used in the different units which go to make up the keyboard, there are 60 different screw machine parts used in assembling the 4 units into the complete keyboard and a total of 660 screw machine parts The other sub-divisions are shown below, the summary showing that a total of 1,377 parts are used in assembling the 4 units into the complete keyboard.

In the same way, the units shown in Columns 6, 7, 8, 9, 10, 11 and 12 go to make up the assembly of the conveyor proper, shown in column 13, while column 14 shows the complete assembly of the two main units into a complete machine. The extreme right-hand column, No. 15, gives the totals of the various kinds of parts. There are, for example, 699 individual screw machine parts, and a total of 16,524 of screw machine parts in the completed machine. In the same way, we find that there are 161 different castings and a total of 1,131 castings. There are 21 assemblies and 5 sub-assemblies. The grand totals below the double line show that there are 1,909 individual parts, and a total of 69,620 in the completed machine. Further down, we find that there are 575 individual assemblies and 12,290 total sub-assemblies. It also shows that 1,222 special tools were made for the machine.

For each of the individual parts, a separate blueprint was made, giving some idea of the thought and labor involved in building a machine of this type. It is difficult to imagine any table which could give more complete information concerning a highly complicated machine than this. The cost of such complete and elaborate data will, of course, be questioned, and it must suffice for the present to say that it is much less than might be supposed. Further details will appear in the two succeeding articles.

An Adventure in Invention

By Harry Botsford

Jack Williams owns and runs a small garage and repair shop in my home town. He does quite a lot of work for me and we know each other fairly well. Jack is a first-rate mechanic but rather scatter-brained as regards business details. At least he was until the events which I want to recount took place—I fancy business methods will mean more to him in future.

One evening last spring Jack came to me in great excitement, carrying a roll of drawing paper under his arm. He proudly spread the paper on my table and, gesticulating with a stubby forefinger, launched into a discourse which made up in enthusiasm what it lacked in accuracy. I finally gathered that Jack was sure he had found a mechanical principle which would revolutionize most of the motor world. Not a chance in the world for it to fail.

Jack's Wonderful Invention

His plan—it really hadn't got beyond that stage—was simplicity itself. The motometer principle was to be applied to the electrical firing in the cylinders, and some sort of a "hicky" (Jack's own word) on the instrument board would show the driver just what kind of a spark each cylinder was getting.

"There's a million in it," Jack told me excitedly. "Every doggoned machine in the world will have 'em. Why once they are put on the market people won't buy a car that doesn't have them. Well, now just think ——" and he was off again. It was easy to see that Jack was sold on his scheme. I tried to calm him down but was only called a wet-blanket for my pains as Jack went blithely on about the millions he knew were waiting for him just as soon as he could "get started." Much to my later discomfiture I finally advised him to perfect the drawings, get the idea patented and then try to sell it to some accessory manufacturer.

I'm sorry I ever encouraged him at all, for now there is a sore spot in Jack's mind against me which my later efforts have only partially eased. And the loss of the good will of one's pet mechanic.

For about three months after Jack's visit to me, I was out of town and by the time I returned I must confess I had almost forgotten the great idea. One day I had some starter trouble and drove in to Jack's garage to receive his usual cheerful attention. But when he came forward with nary a smile and a distinctly accusing look on his face, my thoughts leaped back to that spring evening and with fear in my heart I asked, "How's the invention, Jack?"

Victim of Circumstance

Then I got it. Heated—profane and at length—with a remark here and there that made me feel my part in the disaster. Jack had been made a victim of capital and circumstance and had narrowly escaped with his precious invention intact. What chance had a poor guy even if he did have brains? Dirty bunch of crooks! Must have thought he was a prize boob the way they treated him. Presently Jack just ran out of words and breath and he closed up like a clam—and the starter was fixed in silence. As I left I gingerly asked him to come up to the house and have a talk that night and grudgingly he accepted the invitation. He arrived, glum and silent, a sad contrast to the mad enthusiast of a few months before. Only after smoking two of my best cigars and sampling some of my private stock of—well let's call it ginger ale—did he thaw out enough to tell me his troubles.

It was a sorry tale. Jack had gone ahead with his plans, got an electrician to help with the drawings and spent good money getting the thing patented; eventually becoming the proud owner of certain and sundry imposing papers which admitted that letters patent had been granted to one Jack Williams.

Then the real troubles began. He called on three of the biggest accessory manufacturers in the country and they turned him and his idea flat without looking at it five minutes. "Wanted me to give 'em my papers, the crooks!" He was fully convinced that they were not only against him but also against all new and practical ideas.

Two months later I happened to have a few spare hours in the city where is located one of the manufacturers on whom Jack had called—the largest of them. I determined to call there and try to find just what had been the trouble. I was cordially received by the president; a mighty keen, square business man. I told him my mission and he settled down to talk with a quizzical smile; but when he got through I had some new ideas on inventions and some real news to take home to Jack.

"Yes, I remember Williams very well," he began. "He came in here all enthused over an idea he had patented. He claimed everything in the world for this patent and offered to sell it to us for the insignificant sum of $200,000. We're business men here, our business is to make money; to manufacture and sell things at a fair profit. Naturally, we couldn't very well dash off a check for the desired sum without making some investigation. I explained as much to your friend but he was suspicious. To him, the very fact that his patent had been granted at once implied great merit. He didn't seem to know that of the millions of inventions patented only a small percentage are ever manufactured and only a portion of those are profit makers.

"I called in our chief engineer—one of the best in the game—and Williams did permit him to take a casual look at the papers, but that was all. But that look made the chief shake his head. He has saved us hundreds of thousands of dollars by passing on things with what appears to be a glance, and we have yet to find his judgment at fault. In this case he asked Williams if he had a working model; which of course he hadn't, nor would he permit us to take his plans and make one. That settled the matter as far as we were concerned. We don't buy 'pigs in pokes.'

"We've got to be mighty careful about acquiring patents and introducing new products. It costs a pile of money to do these things, but the average inventor does not stop to consider all that is involved. For example: early last year we bought a patent, an automobile accessory which we will market next year and which obviously I cannot discuss in detail. This unit is not very large but it takes special machinery to make it. We bought the machinery and it cost real money. Then it had to be housed, and that meant an annex to the plant and more money. When we were ready to start manufacturing we had to hire some high-grade specialty mechanics and before we reached and adopted certain standards of material and manufacturing methods we spent some more money. Now we are manufacturing and the product sells very slowly because it is a distinct novelty. Further, we have not been able to advertise it properly in order to create a demand. Our advertising appropriation is distributed over our various lines and the campaign is settled in October; so when a new product is launched it is an orphan until the next appropriation is distributed. Figuring conservatively, this new unit will not show us a profit for two years unless sales jump phenomenally this next year. Is it any wonder we shy at adding a new, unknown thing to our line? Every sane manufacturer feels the same way about it. In the course of a year hundreds of inventors come to this office with their plans and dreams. Not one in a hundred has anything really practical to offer and not one in two hundred has any idea of how to figure profit possibilities and what it means to put out a new product.

Working Model Necessary

"Go back and tell all this to your friend Williams. Show him where he made his mistakes. We want to encourage real inventive ability, and when a real thing is presented to us in a sane manner we will buy it and pay a fair price for it. But it must be practical and we must have a working model, and it will take weeks or months before we can decide. If inventors would only temper their genius with sanity they would carry less grief and I'd have fewer gray hairs."

When I got home I lost no time in telling Jack all about my visit and, although only half convinced, he promised he would try to make a model of his contraption. After working four months he completed the model—it worked after a fashion and spasmodically. But Jack is square, and though it hurt he admitted that he was whipped. He has eaten the harsh words he said to me and the breach seems to be healed. Next time Jack invents something I think he will make his working model before he tries to patent the idea and then when he wants to sell it he can say confidently, "Here it is. Make your tests—tear the thing apart and put it together again—but it *works!* And the manufacturing cost for an ordinary shop will be about as I have outlined. If you decide that you want it, then we'll talk price."

And when that time comes, Jack will sell his invention.

Flash Welding

By A. L. De LEEUW
Consulting Editor, *American Machinist*

Advantages of flash welding over slow butt welding—Current consumption and pressures required—Limitations of flash welding—Welding non-ferrous metals

THE FLASH WELDING method accomplishes the same thing as slow butt welding and does it with what looks at first glance like the same apparatus, and yet is based on quite a different principle.

The butt welding system requires the two pieces to be heated in the manner indicated by Fig. 1. The zone *AB* contains metal at very near the melting point so that it can easily be squeezed out. The zone *BC* contains metal in the plastic state—that is, any layer in this zone is soft enough to make a good weld possible. Beyond *C* lies metal which is heated but not soft enough for welding.

We have seen that a considerable amount of metal must be squeezed out in order to be sure that no oxides

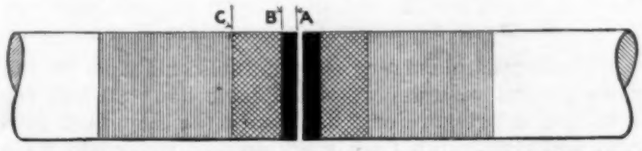


FIG. 1—DIAGRAM OF TWO PIECES BEING BUTT-WELDED

remain and also that considerable pressure is required to cause an even heating. Even then we must have square surfaces, that is, an even bearing for the entire cross section, or else we must have recourse to *nursing*.

Many of the difficulties and problems with which we are confronted when using the butt welding method disappear when we apply the method of flash welding. Fig. 2 shows two pieces in section. They are supposed to have been subjected to the flash weld process but the weld has not been completed. It will be noticed that the opposite faces are very irregular in outline. Of course, the illustration is exaggerated so as to bring out the essentials but, as a matter of fact, the surfaces of such pieces would show a number of high and low spots. If after taking a picture of the pieces we could bring them together again and restore the temperature they had when they were separated, and if then we should proceed with the welding for a very short time, we would find that the appearance had changed.

Action of Flash Welding Arc

There would be low spots where the high spots were before and there would be high spots where the low spots had been. This is caused by the metal of the high spots having been melted away or as it is called "flashed away." This melting away is caused by an arc. Due to the fact that the voltage is very low such an arc cannot form unless the two surfaces are very close together. When it does form, however, the arc has such great power on account of the large amount of current used that the surfaces at which the arc originates are melted away instantly and a crater forms where a high spot was before. As a consequence a couple of new points will now be in close proximity provided, of course, that we have followed up, that is that we have brought the pieces nearer together after part of them had been melted away.

Adjacent Metal Heated

However rapid this melting may be it is not possible for a given section of metal to reach the melting temperature without a certain amount lying immediately behind being heated, although not to a temperature sufficient to melt it. In other words, here again we have a condition of some metal being in the plastic state but in addition to this we also find that whatever metal is melted is immediately blown away by the arc and appears as a stream of sparks thrown out with great force so that it actually becomes necessary to protect the operator by some screen or shield.

To make the arc the operator brings the two pieces together under pressure just sufficient to start the current going through. As soon as the circuit is well established the operator releases the pressure thus reducing the efficiency of the contact to such an extent that an arc forms between the projections nearest together. The metal at this point is melted and blown out and as the operator "follows up," which means keeping the pieces in contact but under very light pressure, a new arc forms at some other point. The arc dances from one

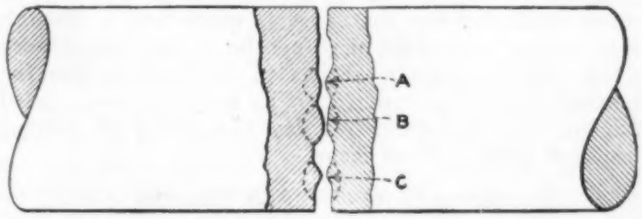


FIG. 2—DIAGRAM OF TWO PIECES BEING FLASH-WELDED

point of the section to another melting away some metal all the time but always at different points of the section so that, however irregular the section may have been at first, after some time enough metal will be melted away to bring the two surfaces even distances apart at all points with the exception, that some of the points are a few thousandths higher or lower than others. These few thousandths are sufficient to make the arc jump over at some points and not at others.

When the metal has been treated this way for some time the entire surface will be heated. In other words,

there will be a layer of plastic material all over the surface. However, whereas in the slow butt welding process this layer of plastic material is quite deep it is very shallow when we apply the flash weld method.

When the surfaces have reached the proper condition the operator suddenly applies considerable force pressing the two pieces together and forming the weld. As practically all of the melted material has been blown out before the pressure was applied there is but very little left to be squeezed out by the pressure and as a result a flash weld shows but a very moderate amount of fin. Fig. 3 illustrates this quite clearly.

Heavy Machine Required for Flash Welding

The fact that the layer of plastic material is very shallow makes two things absolutely necessary. No time must elapse between the moment when the current is shut off and the moment when the pressure is applied and consequently the pressure must be much heavier than that required for slow butt welding. As a result a much heavier machine is required to flash weld a cer-

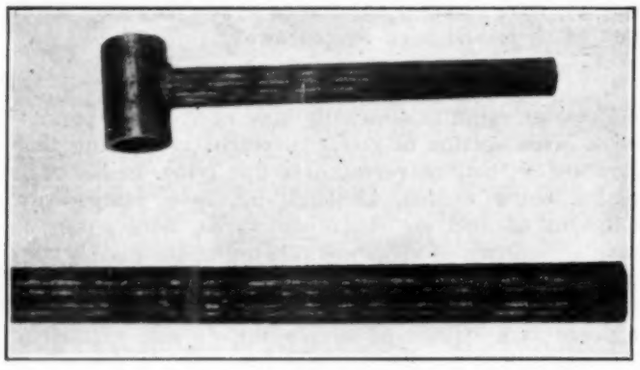


FIG. 3—FLASH WELDS SHOWING SMALL FINS PRODUCED

tain number of square inches of cross section than would be required for slow butt welding. At the present time no machines have been developed which will take in as large sections for this method of welding as for the method previously described.

The voltage also should be higher with the flash weld method. Though the rate of current flow also is greater the amount of current used for the entire weld is smaller than with the slow butt weld process, due to the fact that the time required to make a weld, provided all other conditions are the same, is much less. Though this saving in current may not be of any importance when only a single weld has to be made, where the process is used for manufacturing purposes and applied all day long and day after day the saving of current becomes quite a large item.

Advantages of Flash Welding

The pressure required for flash welding is quite considerable and for this reason this method is particularly desirable for tubes and flat strips where the number of square inches to be welded is relatively small. It has also been applied to solid stock, however, up to 1¼ in. round. The pressure required per square inch is at least 2½ tons.

Though the saving of current is of some importance it is not the main advantage of the flash weld method. As this method has a tendency to even up all irregularities it is not necessary to have the stock cut exactly square. In fact it will actually do away with some machining operations as is clearly shown in Figs. 4 and 5. In Fig. 4 two pieces are shown which have to be welded together to form the product shown in Fig. 5. No attempt is made to miter them, the arc removing all the superflous metal which a machining operation might have taken off to prepare the pieces for welding.

Another advantage of the flash weld method is that one does not need to be careful about the amount of projection beyond the dies. Nor is it necessary to adhere strictly to the rules given in the article on butt welding as to the relative amount of projection when pieces of different materials or different sizes are to be welded together. Though it is still advisable to have approximately the same amount of resistance projecting beyond each die no great difficulties are met if one deviates materially from that rule.

Still another advantage lies in the fact that there is less danger of buckling the pieces even though the pressure per square inch is higher than for the slow butt weld. The higher pressure is more than offset by the possibility of using much less projection of the pieces beyond the dies.

A good picture may be obtained of the relative proportions of current consumption, pressure and time by comparing the results of two actual performances. Welding together two pieces of ½-in. round stock by the slow butt process required a current consumption of 40 kw., a pressure of 1,000 pounds and a time of a little over one minute, while with the flash weld method joining three pieces of ⅜-in. round, there was a current consumption of 75 kw., a pressure of 1,500 pounds and the time was from 8/10 to one second.

Rate of Current Consumption High

Reducing both current consumption and time to the same respective units we would have had 160 kw. for 1 in. and a pressure of 2 tons with the slow butt process while with the flash weld process we would have had a current of 2,133 kw. and a pressure of 21 tons. This shows clearly how much greater the rate of current consumption is with the flash weld method and how much heavier the pressures are. On the other hand the actual current consumption for the same amount of removal of metal would have been 9,600 kw. for one second with the slow butt welding as compared to 2,133 kw. for one second, with the flash weld. In other words the actual current consumption during the day would have been very much less with the flash weld method and the production would have been very much greater on account of the shorter time consumed for one weld.

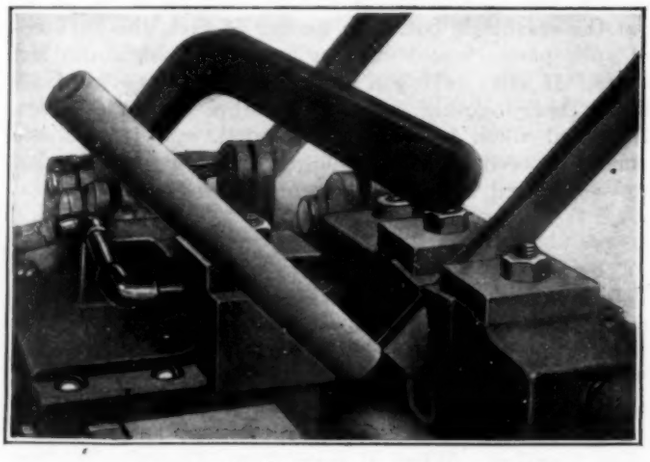


FIG. 4—UNMITERED PIECES SET UP IN FLASH WELDING MACHINE

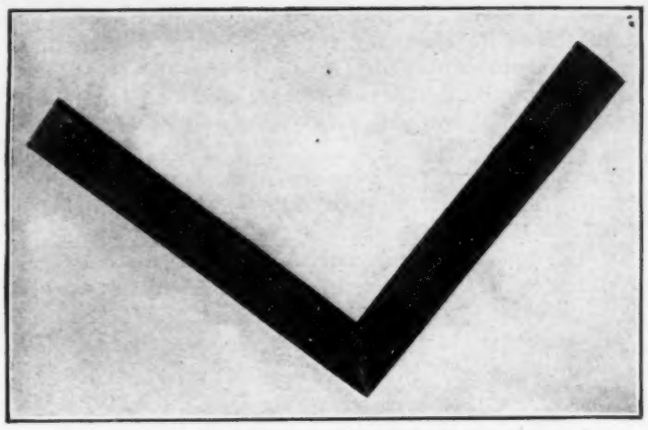


FIG. 5—COMPLETED JOB BEGUN IN FIG. 4

Though it was said that the pressure per sq.in. for the flash weld method is about 2½ tons it should be mentioned that this applies only to the smaller sections and that the pressure per sq.in. rises very rapidly when the sections become larger. It was found for instance that as high as 12 tons per sq.in. is actually required to flash weld two pieces 2½ in. in diameter.

At first glance this rising pressure may seem strange but if one remembers that the surfaces at the moment of welding are not flat but full of little hills and dales and that the layer of plastic material behind these surfaces is quite thin and necessarily must also have such an irregular contour, it will be seen that terrific pressure must be brought to bear on the pieces in order to straighten out this layer of plastic material. It actually becomes necessary to deform the heated material behind the plastic material in order to give this layer the chance to assume the proper shape for welding. The rapidly rising pressure required for the flash welding of large diameter stock limits the method to smaller material and would make it impracticable for heavier stock except for the possibility of employing the slow butt weld and the flash weld method in conjunction with one another.

Hot Flash Welding

The mixed method of butt and flash welding is called *hot flash welding* whereas the method of using the flash weld alone is called the *cold flash*. With the hot flash method the pieces are pre-heated, thus causing a large amount of softened metal to exist before the flash method is applied. The combination of methods does not require any special device or machine. If we should want to weld together two 2½-in. round pieces we would need a machine perhaps somewhat larger than would have been required for the simple slow butt weld process. We would also set the transformer for the proper voltage for flash welding. We would then start the operation as if we were going to make a slow butt weld by pressing the pieces together under considerable pressure provided that the surfaces were bearing fairly square against each other. Should we find that this is not the case, then we do not need to do the nursing previously mentioned. We would simply pull back and start over under very light pressure as if we were going to make a direct flash weld. This would establish the arc and would square up the pieces. However, we would not continue and try to weld the pieces together at this moment as this would require too great a pressure. Instead we would pull the pieces apart and start over again, this time under fairly heavy pressure. We would thus heat up the ends of both pieces but we would not continue the heating as long as we would for butt welding. As soon as the pieces obtain a certain amount of heat we would reduce the pressure and start flashing. A short time after we would suddenly apply the heavy pressure after breaking the circuit. As the metal behind the weld has been softened by pre-heating much less pressure is now required to obtain a perfect weld. Applying this method we will produce a complete weld in about the same amount of time as if we had used the slow butt weld process alone but we will have consumed less power in current and have wasted less metal.

There is practically no limit as to the sizes of the cross sections which can be welded together by the slow butt weld process. On the other hand the flash weld method does offer such a limit. It seems that it is not possible to apply this method when the cross section is more than 5 sq.in. in area, regardless of how much pressure we may wish to apply. The reason is that the pits caused by the arc are so deep that no reasonable amount of pressure would cause the two layers of plastic material to come in intimate contact with each other. Of course, pre-heating would eliminate this limitation as was pointed out before. It should be further said that it does not seem practical to go as far even as 5 sq.in. on account of the enormous size of the machine necessary and the enormous amount of current used though only for a short time. In all cases then where large sections are to be welded together the hot flash weld method should be applied.

Preheating in Flash Welding

The combination of pre-heating and flash welding makes many kinds of welding possible which would ordinarily present great difficulties. Various materials and various cross sections can be welded together by pre-heating one or both. If, for instance, a large section must be welded to a piece of smaller section one merely needs to pre-heat the larger section and then apply the flash method. The same method can be used when welding together different materials such for instance as high speed steel and mild steel, or even ferrous and non-ferrous metals.

In general we may say that when two pieces of ferrous material are to be welded together by the flash weld method we apply the cold flash whenever we have sufficient capacity and the hot flash when the machine at hand has an insufficient capacity.

When attempting to weld non-ferrous metals one is confronted with an essential difficulty if one tries to do it by the slow butt weld process. The difficulty was pointed out in the first article dealing with the principle of resistance welding; namely, that the zone of temperature in which the plastic material is found is very narrow whereas with ferrous material it is quite wide. One might say that when the piece of material is sufficiently heated it is either melted or else it is hard. As a matter of fact, however, there is really a thin layer of plastic material between these two extremes. When trying to use the butt weld method the outer end of the piece must be brought to that state. A fraction of a second more would make the material melt, a fraction of a second less would leave it too hard for welding. This essential difficulty does not exist when we apply the flash weld method because there we have actually a layer of molten material at the extreme end of the piece to be welded so that we know there must be a layer of plastic

material somewhat further back and before we reach the hard material. If then we use the flash method and suddenly apply pressure we will squeeze out the molten metal and bring the two layers of plastic material in contact with each other thus completing the weld.

The amount of projection of the material beyond the die can be made so small when applying the hot flash method that the fin left after welding can be flattened out between the dies so that it is easy to remove. This is of quite some practical advantage.

When flashing together two pieces of non-ferrous metals such as brass, the projection beyond the dies should be two or three times as much as would be used if we were welding soft steel. The reason for this is obvious. We must have a certain amount of resistance beyond the die and we must also have a certain amount of metal which will retain the heat as otherwise the dies would carry off the heat as rapidly as it was generated. It may be remarked here that such metals as copper, bronze and brass have a much higher electrical as well as thermal conductivity.

We have seen that if we must weld two pieces of ferrous material together which are of different cross sections, we can do it by various methods, one of them being the so-called bridge method which is nothing else but a method of pre-heating the piece of large cross-section. This method does not apply when non-ferrous metals are flash welded. The thing to do in such a case is to provide the large piece with an end of the same cross section as the smaller piece. A less desirable method is to flash off more metal. Though this method works, it is rather uncertain and requires a great deal of attention and skill on the part of the operator. The flashing off of extra metal serves the same purpose as the pre-heating when welding ferrous metals.

When welding stellite to ferrous metal the projection of the steel beyond the die should be six to eight times that of the projection of the stellite. To make a successful weld in this case we should start as if we were going to make a slow butt weld, that is, mutually pre-heating the two pieces. To do this we bring them rapidly together and separate them again while the current is on, after which we start the process of flash welding. The same result may be obtained by using a bridge and pre-heating the steel.

For flash welding tubes, perhaps the best method is to first flash off some of the metal and then proceed by the butt weld method which, in this case, will cause neither inside nor outside fin.

Bureau of Standards Report on Copper

Circular No. 73 of the Bureau of Standards is a second edition by the Department of Commerce that gives detailed information concerning copper, such as properties, technology, metallography, treatment, "diseases" and general statistics.

Commercial copper is discussed relating to sources of supply, metallurgy and method of refining. The uses to which each of the three well-defined grades of the metal is put are enumerated and several tables give the composition, production, number of smelters and average price from 1902 to 1921.

A detailed account of the chemical and physical properties of the metal treats of the characteristics such as electrical conductivity, magnetic properties, melting point, boiling point, vapor pressure, thermal conductivity and expansion, specific heat, and density. A list of tables shows its elasticity and its ability to withstand tension, compression, torsion and shear stresses. The influence on the properties of the metal of impurities are discussed thoroughly and illustrated by charts and tables.

The adaptability of copper to various commercial practices such as casting in sand molds, working cold or hot, welding and hardening, is shown by means of charts compiled by the bureau. Such "diseases" as corrosion and burning when being used or worked commercially are also discussed.

An appendix is included that defines the physical terms used in connection with the article on copper, gives typical specifications and standards for the various grades of copper and a bibliography that supplies the reference for any more detailed information on any subject concerning the metal.

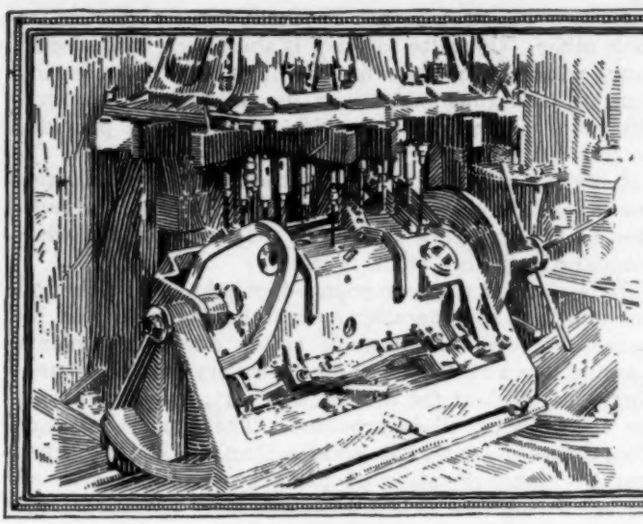
Can Taper Pin Practice Be Standardized?—Discussion

By Walter Wallace

In an article under the above title on page 255, Vol. 58, of the *American Machinist*, Fred H. Colvin gives some very interesting data upon which the standardization of taper pins could be based. He says, "Rounded ends are almost universal, and the radius at each end is usually the same as the diameter of the pin at that end." This fact no doubt has influenced Mr. Colvin to make the following statement at the conclusion of his article: "As a radius equal to the large diameter is easy to remember, it would seem to be the one to adopt for both ends of the pin." The "easy to remember" argument is very good from a psychological point of view but there are other factors to be considered. In designing compact automatic machines this round may be too high. Make your standard conform to this fact. At the present time the Brown & Sharpe taper pin as outlined in the article projects less than the rounded pin of the Hartford Machine Screw Co. A No. 4x1½-in. Brown & Sharpe pin measures 0.208 in. at the small end and projects very little from the work when the hole is drilled with a 0.206-in. drill as recommended in Table V. The height of the radius at the large end equals 0.020 in., whereas if the crown were given a radius equal to its large diameter it would project 0.033 inch.

The Brown & Sharpe taper pin has another valuable feature which was not mentioned in the article, but which should be considered when standardizing. When it comes to disassembling, the machinist can quickly tell which way to drive the pin as the small end is extremely rounded. Other pins are sometimes driven in part way before it is definitely known how to proceed. The strong round on the small end further prevents burring when a tight pin has to be removed because the small end of the pin, as a rule, does not project and in some cases may be considerably under the surface.

A compromise may be desirable, making the small end to Brown & Sharpe standard with a rounded large end, the height of the round equal to $\frac{1}{4}$ of the diameter at the large end or possibly with a radius one-third larger than the diameter at the large end. Certainly the standardization of taper pins ought to be a success. If they are standardized there will be some hope for taper shanks which are a little more chaotic.



Tool Engineering

By
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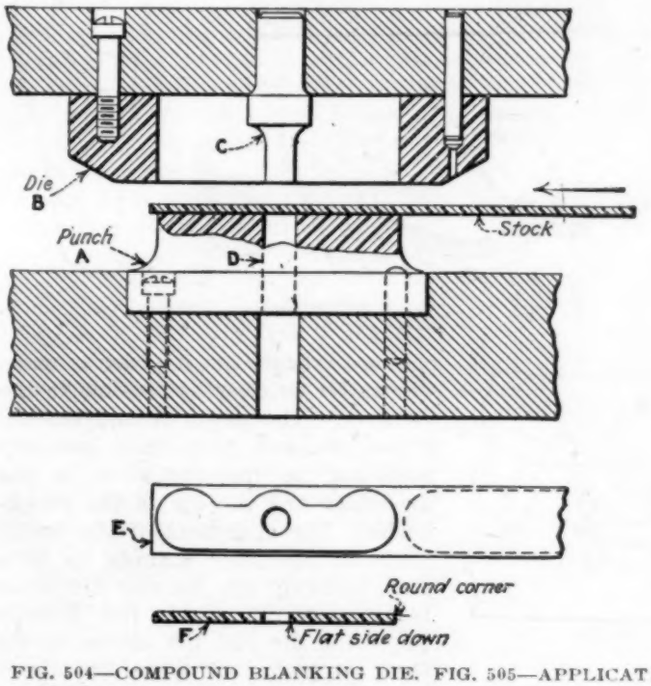
President and Chief Engineer
Dowd Engineering Company, New York City

Compound dies, their principles and advantages—Blanking, piercing, drawing, forming and shaving operations possible—Handling the work and preventing distortion

THE PRINCIPAL difference between compound dies and ordinary blanking dies is that the positions of punch and die are usually reversed, the die of the former type being held in the punch-holder while the punch is held in the die-shoe. Compound dies are so named because frequently both upper and lower members contain punches and dies as well as strippers, in combination. Compound dies may be used for blanking, piercing, forming or shaving and they may be combined for blanking and piercing, piercing and shaving, or blanking, piercing and drawing.

One of the principal advantages in the use of compound dies is that the work produced is much more accurate than that obtained from other types. This is due to the fact that all of the operations are done at one time and at one stroke of the press so that the various members of the die preserve their relation to each other at all times, thus providing for great accuracy in the product. In addition, the stock is gripped between strippers so that it has no chance to move or shift during the operation. Compound dies are generally made of the sub-press type using either the pillar or cylindrical design. Many of the points which require careful consideration are much the same as those which have been given under descriptions of other types of dies.



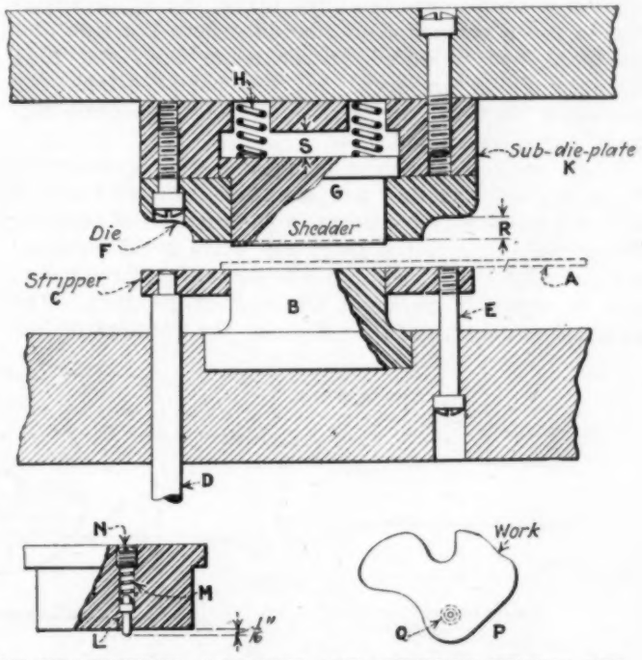


FIG. 504—COMPOUND BLANKING DIE. FIG. 505—APPLICATION OF STRIPPER, SHEDDER AND SHEDDER SPRING PIN

Compound dies may be used on nearly all kinds of die work, but their advantages are more pronounced for certain specific kinds of work. The following examples will assist the reader to understand the different varieties of work to which dies of this kind are most frequently applied. For making plain blanks without holes or openings, a compound die is not generally used because there is no necessity for it. If, however, the

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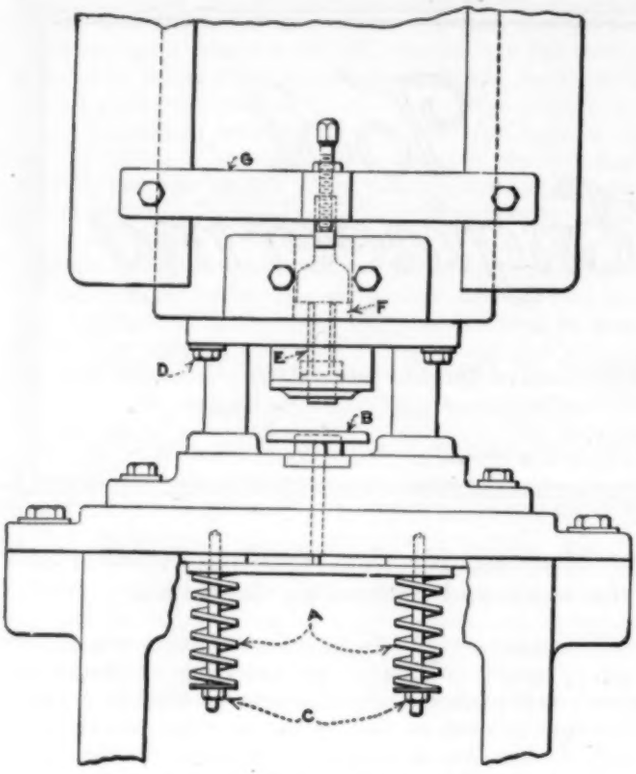


FIG. 506—COMPOUND DIE ON PUNCH PRESS

blank contains a hole which must be held in an accurate relation with the outside of the blank, it may be advisable to use a compound die, because here the hole and the blank are produced at the same time and thus the accuracy is preserved. A few parts suitable for production in this type of die are gears, washers, ratchets, cams, levers and links.

When work is produced by means of progressive or "tandem dies" (as they are sometimes called) there is always a possibility of errors in the relation of the outside of the blank to the hole; and when great accuracy is required it is better practice to make use of compound dies in order to preserve the correct relation. The piercing punches and the die for the contour of the work are placed together in their correct relation to each other. Opposite to them is the punch for the contour, which also contains openings for the piercing punches and thus becomes a die as well as a punch. Strippers having strong spring pressure are provided so that each part is kept under compression while the cutting is done, and that when the punch is withdrawn the blank is pressed back into the stock. Another function of the strippers is to keep the punching flat when comparatively thin stock is used.

It is claimed that compound dies hold their sizes better and last considerably longer than other styles because there is less abrasive action due to the blanks passing down through the dies. A very small clearance angle is sufficient for dies of this sort, and occasionally no clearance at all is provided. The expense of compound dies is somewhat greater than the simpler types, but by standardization of parts economies can be effected so that the prices are made more reasonable. In making up dies of this kind the use of the sub-press type is almost a necessity and any other method is not generally considered.

In order to illustrate clearly the principles involved in the design of compound dies, the diagrams shown in Fig. 504 are given as a reference. The illustration presents a very simple type of die in which principles

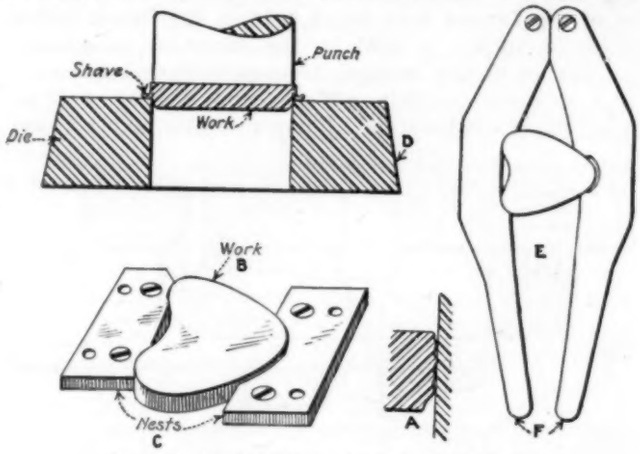


FIG. 508—PRINCIPLES OF SHAVING DIES

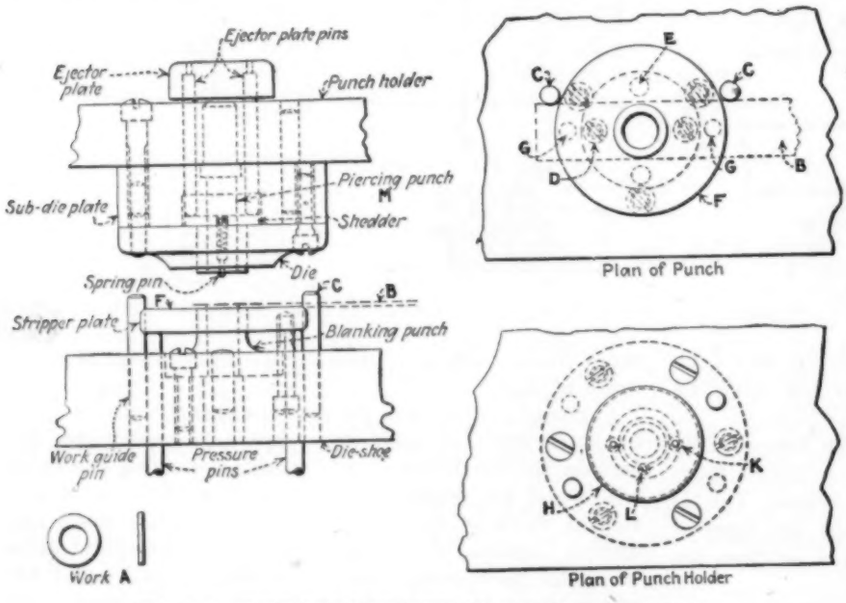


FIG. 507—COMPOUND BLANKING AND PIERCING DIE

only are brought out in order to make the matter as clear as possible to the designer. The punch *A* and the die *B* are reversed from their ordinary positions, as the punch is in the die-holder and the die in the punch-holder. The alignment of the two is made in the same manner as in a plain blanking die, the only difference being that the punch lies directly below the die and the action on the stock is such that when the die is brought down on it the punch forces the blank up into the die.

On this piece of work a hole is to be pierced in the center of the stock, which work is done by means of a piercing punch *C* located in the center of the die and fitting the hole *D* in the lower punch, which also acts as a die. When work is blanked by this method the top or upper side of the piece is slightly rounded, and there-

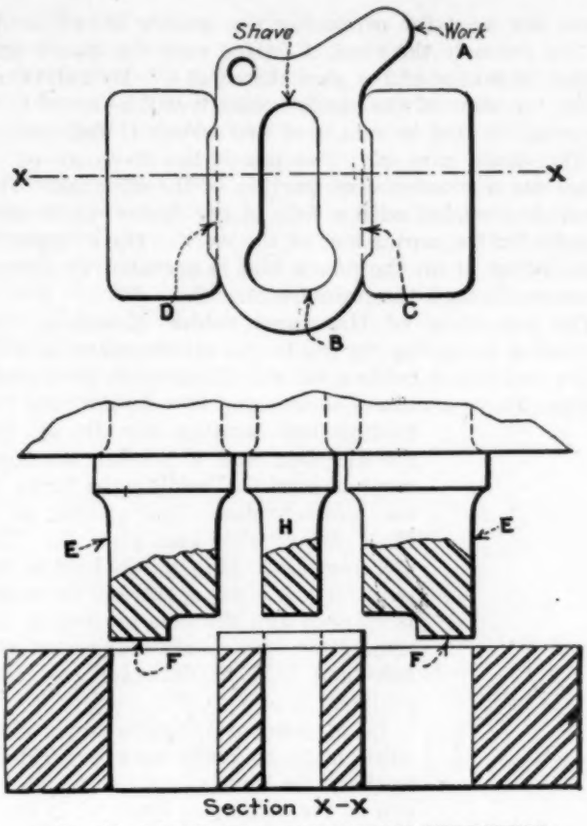


FIG. 509—STOPPING BLANK FROM SPRINGING WHEN SHAVING

fore when making a layout for a compound-die blank the flat side must be shown down. This is apparently contrary to the rule which we previously mentioned, but the flat side is still located against the punch. In the example *E* a layout for a piece of work to be produced by a compound die is shown, and at *F* the sectional view illustrates the round corner.

As previously stated, this example is of the simplest form and illustrates only the principles of the compound die. It will be seen that if the work were produced in a die of this sort a portion of the stock which lies around the blank, or in other words the "scrap," would be forced down over the punch in such a way that it would be hard to remove. Consequently, the die must be provided with a "shedder" and the punch with a stripper.

In Fig. 505 is shown the application of both shedder and stripper as applied to a compound die. The work *A* in this example is fed over the punch *B*, which has a stripper *C* surrounding it. The stripper is operated by means of pressure pins *D* to which spring pressure is applied, the upward movement being limited by the screws *E*. These latter are so placed around the stripper that they will keep it in horizontal position and at the correct height. In the die *F* the opening is provided with a shedder or ejector *G* fitted into it and having a shoulder as shown to limit the movement. Pressure is applied to the shedder by means of the coil springs *H*, which should be so proportioned that they will exert enough pressure to throw out the blank easily. A "sub-die-plate" *K* is used here in order to simplify the manufacturing. The cost is materially reduced by making the die in this manner.

In action, after work has been suitably located over the punch, the die is brought down so that it strikes the stock and continuing downward produces the blank. At the same time it causes the portion of stock around the blank to force the stripper down a corresponding amount, and simultaneously with this the shedder strikes the blank and holds it down firmly on the punch. As the die is withdrawn the shedder throws the blank out of the draw opening, but allows it to remain firmly seated against the punch while the stripper throws the scrap portion of the stock upward until it surrounds the blank. In this way the blank itself is forced back again into the stock so that when the latter is moved along, the blank goes with it.

In some cases the stock is oiled before being blanked, which may cause the blank to adhere to the shedder and be carried upward. If this should happen when the work is fed automatically, the previously blanked piece of work would cause injury to the die on the next stroke of the press. In order to avoid any trouble of this sort the shedder is frequently provided with a spring pin such as that shown at *L*. This pin normally projects $\frac{1}{32}$ in. or so below the face of the shedder, and pressure is applied to it by means of the spring *M*, which is backed up by a headless setscrew *N*. At *P* an outline of the work is shown being produced in this die, the location of the shedder spring being indicated at *Q*. Whenever possible the pin should be located at the front of the shedder, in order that the operator may have the opportunity to see whether it is working properly.

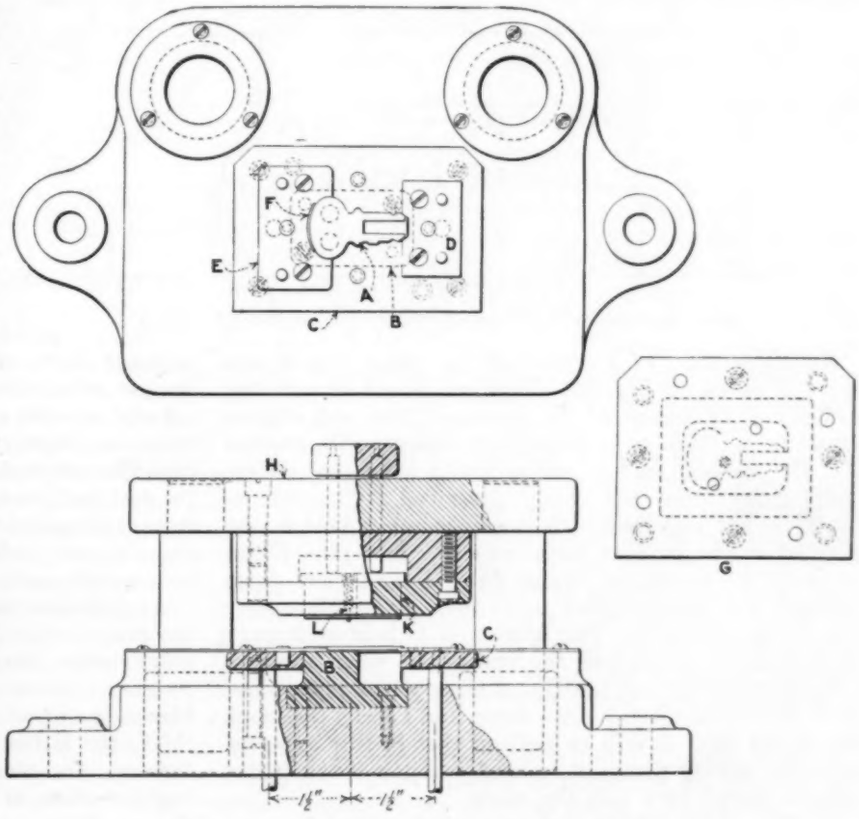


FIG. 510—COMPOUND SHAVING DIE FOR KEY

There are cases now and then when the shape of the work will not permit locating the pin in such a position, and when an occasion of this sort arises the pin must be placed elsewhere.

By standardizing the parts of a compound die such as the sub-die-plate, the die and shedder, it is often found that considerable savings can be effected. The amount of stock which can be ground from the face of the die is indicated at *R*. This dimension for work up to ¼ in. flat is generally made about ¼ in., while the entire thickness of the die is ⅝ in. The thickness of the sub-die-plate should be about 1 in. for the same size blanks, and the shoulder on the shedder about ⅜ in. There should be about ⅛-in. movement of the ejector in the sub-die-plate, as indicated at *S*, which is the clearance space.

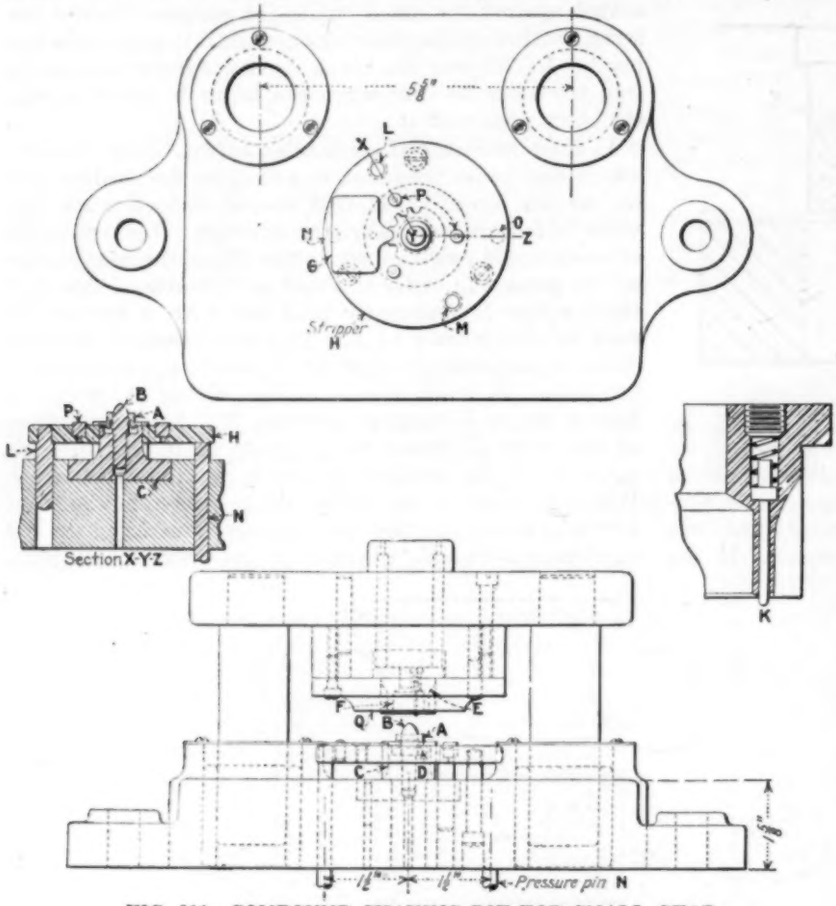


FIG. 511—COMPOUND SHAVING DIE FOR SMALL GEAR

An installation of a compound die fitted to a punch press is shown in Fig. 506. The springs *A* actuate the stripper *B* by means of the pressure pins, and adjustment can be made by tightening or loosening the nuts at *C*. The shedder in this set-up works somewhat differently from those previously described. The punch-holder is not provided with a shank, but is held to the ram by means of four capscrews *D*. Two pins *E* are fastened to an upper ejector plate *F* and pass down through the punch-holder until they strike the upper face of the shedder. The bracket *G* is held stationary on the upper portion of the press, and when the ram returns to its highest position a lever which is fastened to it forces the ejector plate down and knocks the blank out of the die. It will be noticed that in this arrangement no spring pressure is used and the blank is not always forced back into the stock.

In Fig. 507 is shown a very good example of a compound die used for producing the washer shown at *A*. In this example the stock *B* is fed over the punch and guided by means of the pins shown at *C*. By referring to the top view of the punch-holder it will be noted that the punch is held by means of two screws *D* and located by the dowel pins *E*. The punch has a flange on it which fits a counterbored portion in the die-shoe. The punch is provided with a hole in the center which acts as a die for the center hole of the work. The stripper *F* is a sliding fit on the punch and is operated by spring pressure through the pressure pins *G*.

The top view of the punch-holder illustrates the method of fastening the die to the sub-die-plate, as well as the method of holding the sub-die-plate to the punch-holder. There are three screws and two dowels used for holding and locating the die on the sub-die-plate and a similar arrangement is used for holding the latter to the punch-holder. The ejector plate *H* is fitted with two pins *K*. The piercing punch *M* is rigidly held in the punch-holder. In operation the work is blanked and the hole pierced at the same time, the result being that the hole and outside diameter are concentric.

It is frequently necessary, when work is to be made very accurately, to shave the blanks in a compound die, and as the principles involved in shaving dies have not been previously described we will illustrate a few examples here. Fig. 508 illustrates the principle of shaving but does not show its application to a compound die. It will be remembered that when a piece of work is blanked both flat and round sides are produced. In looking carefully at the contour of a blank form made in a regular blanking operation, it will be noted that the edge is very rough. In many operations it is not possible to use a blank of this sort, and therefore a "smoothing-up" operation is necessary.

If the blank must be strictly interchangeable with other similar blanks and requires additional machining, it is not always necessary to obtain this result by a profiling operation, although it is often done in this way. If a certain amount of stock can be shaved off by means of a die, the reduction in the cost of production is well worth considering, as it is obvious that the operation is much cheaper than that of profiling. It may be well to state here that the tool designers in many modern shops do not realize the advantages of shaving operations and that there are many pieces profiled which can successfully be produced on a punch press by means of shaving dies.

An enlarged section of the blank is shown at *A* and the ragged edge is exaggerated in order to illustrate the point more clearly. The heavier the blank is, the rougher the surface. In other words, in comparing two blanks one of which is ⅛ in. thick and the other one ¼ in. thick, the latter will be found much rougher than the former. In order to remove this rough edge by a shaving operation, it is necessary to determine how deeply the roughness extends. It is often necessary to make

two shaving operations in order to eliminate the roughness to as great an extent as possible.

Various shops differ in their methods of determining the amount of stock to be removed by the shaving operations, and the method depends somewhat upon the material used. One of the simplest rules is to allow 0.003 in. to each $\frac{1}{32}$ in. thickness of the blank, the minimum amount being 0.002 in. Occasionally the amount is worked out by means of a percentage ratio; for example, a soft steel stamping having only one shaving operation would require an allowance of 5 per cent of the thickness of the blank for shaving. If two shaving operations are necessary, 6 per cent or so are allowed, 4 per cent being taken off at the first shaving and 2 per cent at the second shaving, making a ratio between the

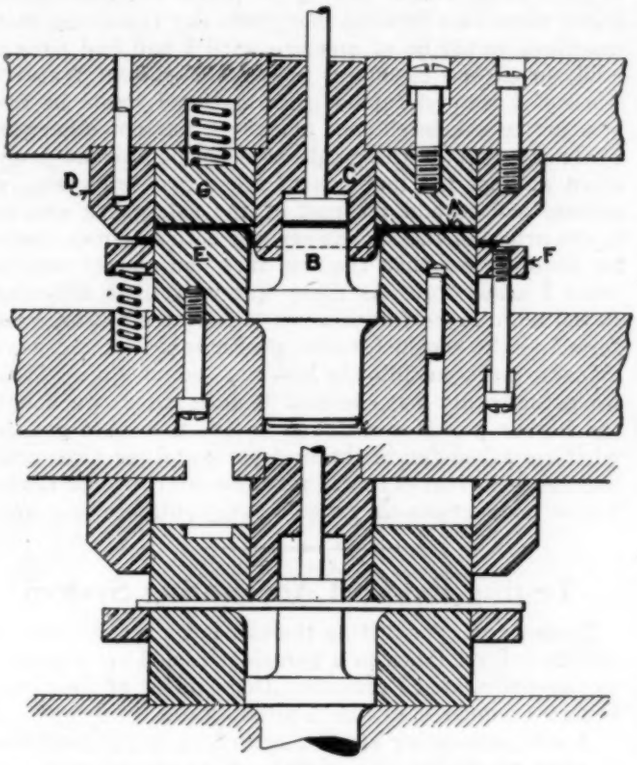


FIG. 512—COMPOUND BLANKING, PIERCING AND DRAWING DIE

amounts of metal removed in the first and in the second operations of 2 to 1.

For work $\frac{1}{32}$ in. thick or over, two shaving operations are generally necessary. The advantage of this method is that the first shave does not smooth up the blank entirely but leaves a set of fine ridges or grooves, which are almost eliminated by the second shaving. In shaving a hole the allowances are about the same. Many factories produce blanks in which the holes must be very accurate, and instead of shaving, ream them, although it is not as satisfactory a method. Manufacturers in general are beginnig to realize the advantages of shaving operations, so that the method is being adopted more and more.

Many blanks are irregular in shape, and before shaving it is necessary to nest or locate the work properly. In the example *B* the work has an irregular contour and the method of location is by means of the nests *C*. When work has previously been provided with holes which are not to be shaved they may often be used for locating purposes, instead of nests. If a gear is to be shaved in a compound die, the work can be located by a center plug and one nesting plate to locate one of the gear teeth. In a plain shaving die, however, it is not considered good practice to use a locating plug in the punch and depend upon it for straightening up the work before the shaving is done. The work to be shaved by the die *D* should be located by means of some form of swinging nest or locater. The method indicated at *E* may be found useful for work of this character. The locating plates *F* hold the work until the punch forces the blank down through the die. These plates are then spread apart so that the chips produced by the shaving can be readily removed.

Preventing Distortion in Blank When Shaving

When an inside hole or a form is to be shaved, if the walls of the work are thin, there is a tendency to spread or distort the blank; it is therefore necessary to provide some means of preventing anything of this sort. Fig. 509 shows a method which can be used for this purpose. The work *A* in this example has a hole *B* which is to be shaved. If the shaving punch were forced down through the work, the hole would probably open up and stock would be removed at the ends of the opening only. In other words, the shaving operation would not be successful on account of the distortion. Therefore, when work is blanked, a suitable amount of stock should be left on the edges at *C* and *D*, so that when the shaving operation takes place these portions will be shaved at the same time.

The section *X-X* in the lower part of the illustration shows the work located ready for shaving. Two punches *E* are provided with heels *F* which enter the die previous to the shaving operation, thus holding the punches from springing when they come in contact with the work. As the punches descend, portions *D* and *C* are shaved at the same time that the center hole is shaved by means of the punch *H*.

Compound Shaving Die for Key

In Fig. 510 is shown a compound shaving die for shaving the key shown at *A*. We have illustrated in a previous article the blanking and piercing die for this piece of work, and the die shown shaves the portion previously mentioned. In general, the construction of this shaving die is similar to the die shown in Fig. 507 and embodies many of the principles which have been noted. The punch, which is shown at *B*, has a stripper *C* surrounding it that is provided with locating nests at *D* and *E*. The plate *E* is relieved at *F* to avoid an unnecessary amount of locating surface. The nests are thinner than the blank being shaved so that the die will strike the blank before it comes in contact with the nests.

The die *G* is of rectangular form as indicated in the plan view, and it is secured to the punch-holder *H* by screws and dowels. The shedder *K* is provided with a spring-pin *L* which projects below the face of the shedder. The purpose of this pin has been mentioned previously. A special die-plate is used in this construction, and the die itself is of the sub-press type of standard design having bushings in the die-shoe for the guide pins, as well as felt oiling pads. It may be considered as a good example of modern shaving die construction.

A compound shaving die for a driving gear is shown in Fig. 511. The general construction of this die is similar to that in the previous example, except that the dies in the punch and various other parts are round

instead of rectangular. The method of locating the blank *A* is by means of the locating stud *B* which is held in the punch *C*. The stud is rounded to provide quick and accurate location. The work *A* has a hub on both sides and it is necessary to provide clearance in the punch by counterboring it as shown at *D*. The shedder *E* is also made with clearance at *F*. The work is located by means of a nesting plate *G*, which is located on the stripper *H* shown in the plan view.

At *K* is shown a 4 to 1 scale drawing of a section through the shedder to illustrate the method of locating the shedder spring pin. Difficulties sometime arise in the location of this pin when an odd-shaped piece of work is to be handled. A plain steel ball is sometimes used in place of a pin, the ball being backed up by a spring and arranged so that it protrudes through the shedder like the pin. Either pin or ball can be used successfully.

Attention is called to the use of the stripper guide pins *L* and *M*, one of which is shown in the section taken along the line *X-Y-Z*. These pins fit the thread holes in the die-shoe and slide up and down during the punching operation, thus assuring accurate location. Spring pressure is applied in the usual manner through the spring pins *N* and *O*. Another point of importance is the application of the leveling studs *P*. There are three of these studs which strike against the face of the die *Q* as it comes down, so that it is leveled to make a good and accurate contact with the work.

Compound Die for Blanking, Piercing and Drawing

In the first part of this article we stated that it is possible to design a compound die not only for blanking and shaving but also for blanking, piercing and drawing. Fig. 512 shows an interesting example of a compound die for blanking, piercing and drawing the piece of work shown at *A* and indicated by the heavy lines. The construction of this die is different from any of the other blanking and drawing dies we have described, as the die is held in the punch-holder and the blanking punch in the die-shoe. This type of tool is very often called a combination press tool.

The first operation performed is the piercing of the center hole, which is done by means of the punch *B* and the die *C*. This die also acts as a forming block for forming the drawn portion. After the forming has been completed, the die *D* comes down over the punch *E* and blanks the work to size. The punch is provided with a stripper *F*. A pressure ring *G* is used to hold the work while the center portion is being drawn, to prevent the stock from wrinkling. In the lower part of the illustration the die is shown in an open position with a blank in place just before the operation is started.

Selling Machine Tools—Discussion

By Edgar Allen

I have read Entropy's article, under the above title, on page 854, Vol. 57, of the *American Machinist* and also Mr. Blair's comments on page 158, Vol. 58. I was especially interested as I had a rather exasperating experience with some machine salesmen not long ago. The management had discussed some proposed extensions and I sent out three letters to well known firms asking for circulars describing a certain type of machine, together with prices for the various sizes. Two of the firms written to were 216 miles from our shop and the third one was 285 miles away. One of the nearer firms sent me the asked for circular together with a nice letter advising me they would give me any further information desired, or would refer me to several nearby users of similar equipment purchased from them. The other two firms informed me—one by wire—that their representatives would call on me in a day or two. Sure enough, both representatives came in on the same train at a time when I could hardly spare a minute for either of them. However, I took the time to be frank with them and told both that at that time I was not in the market for such a machine, but was gathering information for presentation to the management. I also showed them a copy of the letter I had sent out to their firms, simply asking for prices and description. I told them that nothing they could say regarding their machines would be of any use until I had had time to study over the circulars, prices and special features. Then if I wanted further information I would be in a position to ask intelligent questions, but not otherwise. The net result of these calls was that I became prejudiced against the methods of these two firms who, of course, had to add the cost of the salesmen's expense to the prices of their machines, yet both salesmen quoted me lower prices than the firm that had merely sent me what I asked for. As there was very little difference in the build or performance of these three makes, I was forced to the conclusion that poorer material and workmanship were put into the lower priced machines. When we actually did buy, several months later, we bought the higher priced machine from the firm that gave us what we asked for in the first place and we have never had cause to regret it. If manufacturers would always follow instructions they would save considerable money.

Testing the Cost Accounting System

Twelve rules for testing the value of a cost accounting system are set down in a pamphlet issued very recently by the Fabricated Production Department of the Chamber of Commerce of the United States.

A cost accounting system, according to the pamphlet, is very much like the engine of an automobile, only "there are more kinds of cost systems than gas engines and their vagaries and non-performances are just as many—if you have not the right kind."

"A car that doesn't operate right," the pamphlet goes on to say, "costs a lot in repairs, and a cost system that fails to show what it should, consumes profits.

"It will pay to check out on your system as you would on your car. You ought to know the upkeep and if it pays."

The rules to apply in analyzing the soundness of a cost system as set forth in the pamphlet are:

Does your cost system give you up-to-date costs, not merely history?
Does it aid in stabilizing your wages and piece-work rates?
Does it point out defects in your routing system?
Does it help you maintain a perpetual inventory?
Does it increase your production?
Does it measure your overhead?
Does it detect new overhead expense?
Does it point out leaks in expense?
Does it encourage your employees?
Does it promote intelligent competition?
Does it point to non-profit paying lines?
Does it permit you to bid safely?

Management Methods and Principles of Frank B. Gilbreth, Inc.—III

By K. H. CONDIT
Editor, *American Machinist*

The principles upon which the process chart is constructed and the tools used—Functions of the organization chart—Route models and their use

THE CRITICISM usually made of the process chart when one sees it for the first time is that it is hopelessly complicated and must cost a lot to construct. As a matter of fact the case is quite the reverse. Typical charts used in munition work during the war are shown in Figs. 5 and 6. A little study of these two charts will show that a triangle is used to represent a raw material or other ingredient

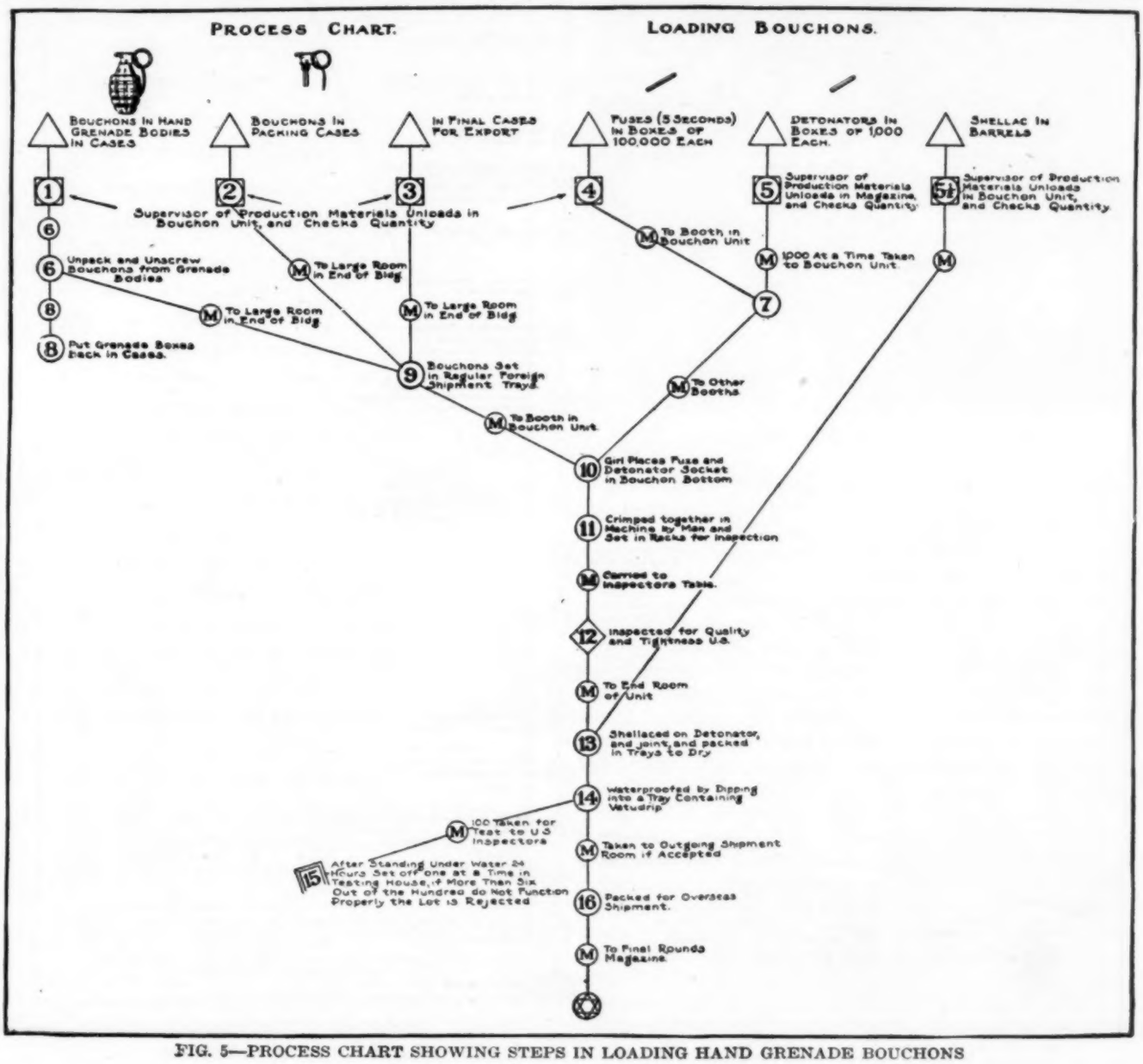

PROCESS CHART.
LOADING BOUCHONS.
Bouchons in Hand Grenade Bodies in Cases
Bouchons in Packing Cases
In Final Cases for Export
Fuses (5 Seconds) in Boxes of 100,000 Each
Detonators in Boxes of 1,000 Each.
Shellac in Barrels
Supervisor of Production Materials Unloads in Bouchon Unit, and Checks Quantity
Supervisor of Production Materials Unloads in Magazine, and Checks Quantity
Supervisor of Production Materials Unloads in Bouchon Unit, and Checks Quantity
To Booth in Bouchon Unit
1000 At a Time Taken to Bouchon Unit
Unpack and Unscrew Bouchons from Grenade Bodies
To Large Room in End of Bldg
To Large Room in End of Bldg
To Large Room in End of Bldg
Put Grenade Bodies Back in Cases.
Bouchons Set in Regular Foreign Shipment Trays
To Booth in Bouchon Unit
To Other Booths
Girl Places Fuse and Detonator Socket in Bouchon Bottom
Crimped together in Machine by Man and Set in Racks for Inspection
Carried to Inspectors Table.
Inspected for Quality and Tightness U.S.
To End Room of Unit
Shellaced on Detonator, and joint, and packed in Trays to Dry
Waterproofed by Dipping into a Tray Containing Vetudrip
100 Taken for Test to U.S Inspectors
Taken to Outgoing Shipment Room if Accepted
After Standing Under Water 24 Hours Set off one at a Time in Testing House, if More Than Six Out of the Hundred do Not Function Properly the Lot is Rejected
Packed for Overseas Shipment.
To Final Rounds Magazine

FIG. 5—PROCESS CHART SHOWING STEPS IN LOADING HAND GRENADE BOUCHONS

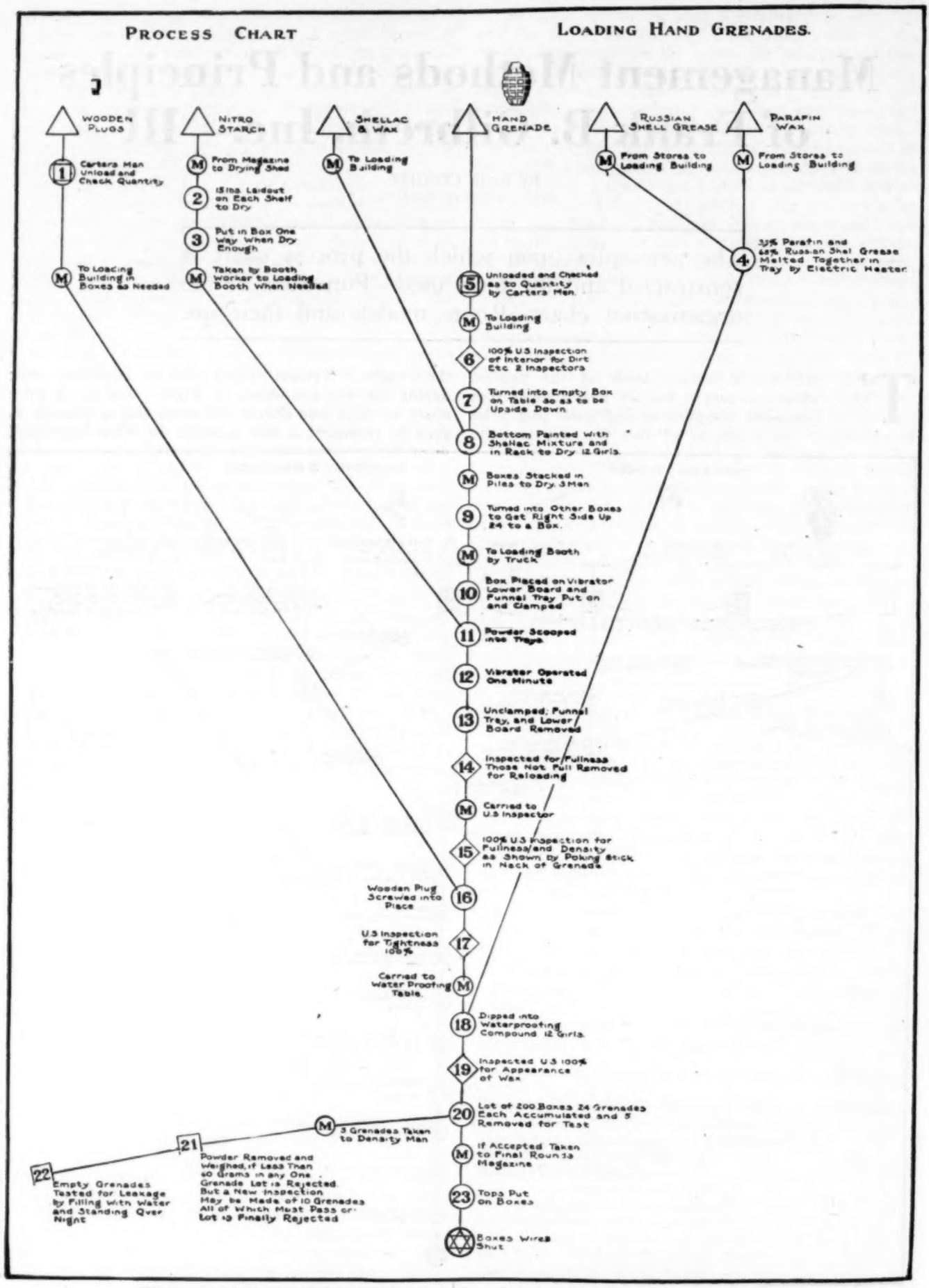

PROCESS CHART
LOADING HAND GRENADES.
WOODEN PLUGS
NITRO STARCH
SHELLAC & WAX
HAND GRENADE
RUSSIAN SHELL GREASE
PARAFIN WAX
1 Cartons Men Unload and Check Quantity
M From Magazine to Drying Shed
2 15lbs Laidout on Each Shelf to Dry
3 Put in Box One Way When Dry Enough
M To Loading Building
M From Stores to Loading Building
M From Stores to Loading Building
4 33% Parafin and 66% Russian Shel Grease Melted Together in Tray by Electric Heater
M To Loading Building in Boxes as Needed
M Taken by Booth worker to Loading Booth When Needed
5 Unloaded and Checked as to Quantity by Cartons Men.
M To Loading Building
6 100% U.S Inspection of Interior for Dirt Etc 2 Inspectors
7 Turned into Empty Box on Table so as to be Upside Down
8 Bottom Painted with Shellac Mixture and in Rack to Dry 12 Girls.
M Boxes Stacked in Piles to Dry 3 Men
9 Turned into Other Boxes to Get Right Side Up 24 to a Box.
M To Loading Booth by Truck
10 Box Placed on Vibrator Lower Board and Funnel Tray Put on and Clamped
11 Powder Scooped into Trays
12 Vibrator Operated One Minute
13 Unclamped; Funnel Tray, and Lower Board Removed
14 Inspected for Fullness Those Not Full Removed for Reloading
M Carried to U.S Inspector
15 100% U.S Inspection for Fullness and Density as Shown by Poking Stick in Neck of Grenade
Wooden Plug Screwed into Place 16
U.S Inspection for Tightness 100% 17
Carried to Water Proofing Table. M
18 Dipped into Waterproofing Compound 12 Girls.
19 Inspected U.S 100% for Appearance of Wax
20 Lot of 200 Boxes 24 Grenades Each Accumulated and 5 Removed for Test
M 5 Grenades Taken to Density Man
21 Powder Removed and Weighed, if Less Than 40 Grams in any One Grenade Lot is Rejected But a New Inspection May be Made of 10 Grenades All of Which Must Pass or Lot is Finally Rejected
22 Empty Grenades Tested for Leakage by Filling with Water and Standing Over Night
M If Accepted Taken to Final Round Magazine
23 Tops Put on Boxes
Boxes Wired Shut

FIG. 6—PROCESS CHART ILLUSTRATING PROCEDURE IN LOADING HAND GRENADES

STORES REQUISITIONED
STORES BOUGHT
STORES RECEIVED
SEVERAL KINDS OF COMPONENTS - NOT DESIRABLE TO LIST INDIVIDUALLY
WORKED MATERIALS REQUISITIONED
WORKED MATERIALS ORDERED
WORKED MATERIALS ON HAND
MERCHANDISE IN STORAGE READY TO SHIP.
STORAGE AS PART OF PROCESS
PERMANENT FILE OF ANY DOCUMENTS OR MATERIALS
TEMPORARY FILE OF ANY DOCUMENTS OR PAPERS
OPERATION SYMBOL - WITH NUMBER, SIGNIFIES OPERATION NO. 38 OR BY OPERATOR NO. 38
MOVED BY OPERATOR PERFORMING OPERATION NO. 38
MOVED BY MAN
MOVED BY BOY
MOVED BY MESSENGER BOY
MOVED BY ELEVATOR
MOVED BY PNEUMATIC TUBE
MOVED BY CONVEYOR.
GRAVITY - MOVED BY GRAVITY CONVEYOR
BELT MOVED BY BELT CONVEYOR.
- MOVED BY TRUCK.
ELECTRIC - MOVED BY ELECTRIC TRUCK (SUBSTITUTE - GASOLINE, HAND, LIFT, AS CASE MAY BE.)
- INFORMATION OR MESSAGE MOVED BY TELEPHONE.
- MOVED BY MAIL
INSPECTION FOR QUALITY.
INSPECTION FOR QUALITY BY SEEING.
INSPECTION FOR QUALITY BY SMELLING.
INSPECTION FOR QUALITY BY HEARING
INSPECTION FOR QUALITY BY TASTING.
INSPECTION FOR QUALITY BY FEELING.
INSPECTION FOR QUALITY BY KINAESTHESIA
INSPECTION FOR QUANTITY
INSPECTION FOR QUANTITY BY WEIGHING. WEIGHT COUNTING.
INSPECTION FOR QUANTITY BY COUNTING.
INSPECTION FOR QUANTITY BY DRY OR LIQUID MEASURING.
INSPECTION FOR QUANTITY BY SEEING IS THERE AT LEAST ENOUGH? IS A PIECE MISSING FROM TRUCK OR PACKET?
INSPECTION FOR QUANTITY BY AUTOMATIC COUNTING.
INSPECTION FOR QUANTITY AND QUALITY (QUANTITY MOST IMPORTANT).
INSPECTION FOR QUALITY AND QUANTITY (QUALITY MOST IMPORTANT).
OVERINSPECTION FOR QUANTITY
OVERINSPECTION FOR QUALITY
INSPECTION FOR QUANTITY ON EXCEPTION PRINCIPLE
INSPECTION FOR QUALITY ON EXCEPTION PRINCIPLE.
OVERINSPECTION FOR QUANTITY ON EXCEPTION PRINCIPLE
OVERINSPECTION FOR QUALITY ON EXCEPTION PRINCIPLE
INSPECTION FOR QUANTITY AND OPERATION PERFORMED SIMULTANEOUSLY.
INSPECTION FOR QUALITY AND OPERATION PERFORMED SIMULTANEOUSLY
INSPECTION FOR QUANTITY AND QUALITY AND OPERATION PERFORMED SIMULTANEOUSLY (QUANTITY MOST IMPORTANT).
INSPECTION FOR QUALITY AND QUANTITY AND OPERATION PERFORMED SIMULTANEOUSLY (QUALITY MOST IMPORTANT).
NO. 485
BLANK FORM USED — INDICATES NO 2 COPY OF FORM 485 IF THERE IS BUT ONE COPY OF FORM MADE, FORM NUMBER APPEARS IN CENTER OF BLOCK
DAILY EXCHANGE REQUIRED
REPORTS NOT HAVING FORM NUMBERS WILL HAVE BRIEF TITLE WRITTEN IN BLOCK
A SINGLE DEPARTMENT USED MORE THAN ONCE
BROKEN LINES INDICATE PROCESS OUTSIDE OF THE DEPARTMENT CHARTED - USED ON DEPARTMENTAL CHARTS.
PROCESS WITHIN THE DEPARTMENT IS CONNECTED WITH CLOSED LINE.

FIG. 7—STANDARD SYMBOLS FOR PROCESS CHARTS

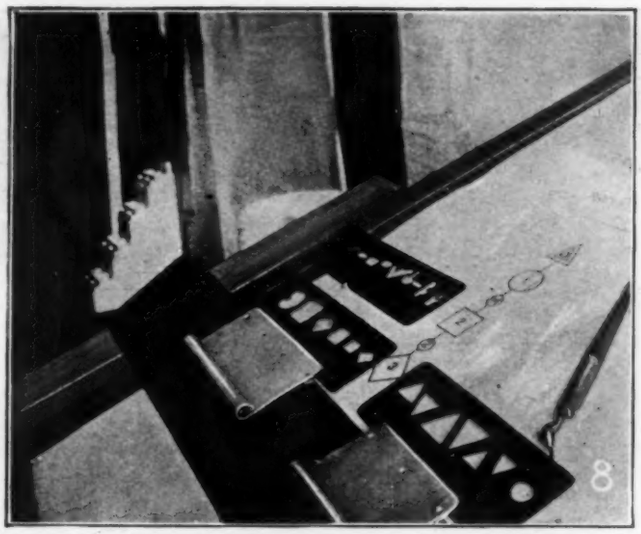


FIG. 8—STENCILS AND PEN USED IN MAKING PROCESS CHARTS

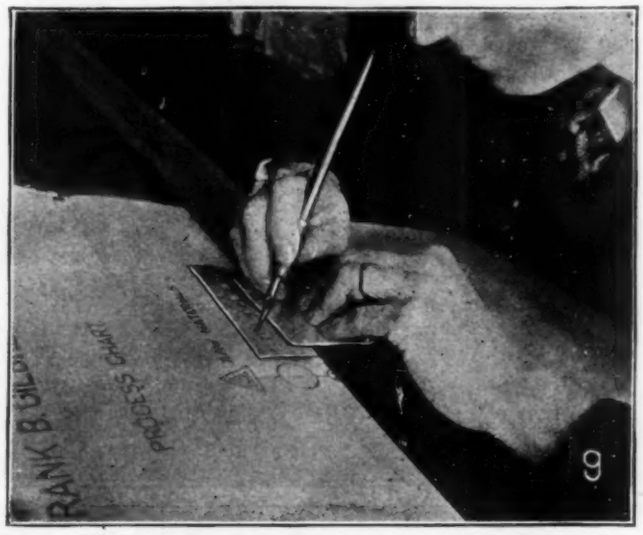
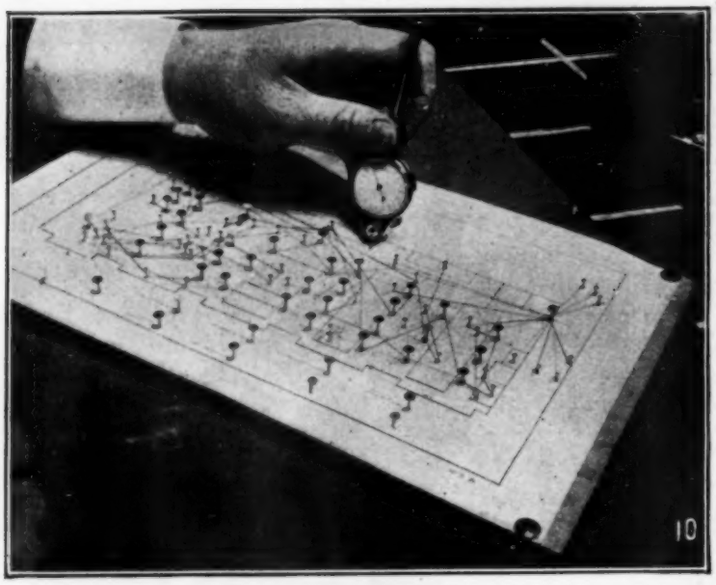


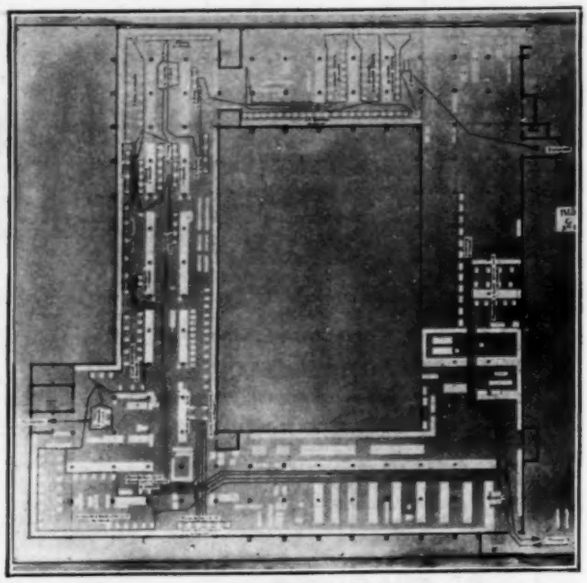
FIG. 9—DRAFTSMAN MAKING PROCESS CHART

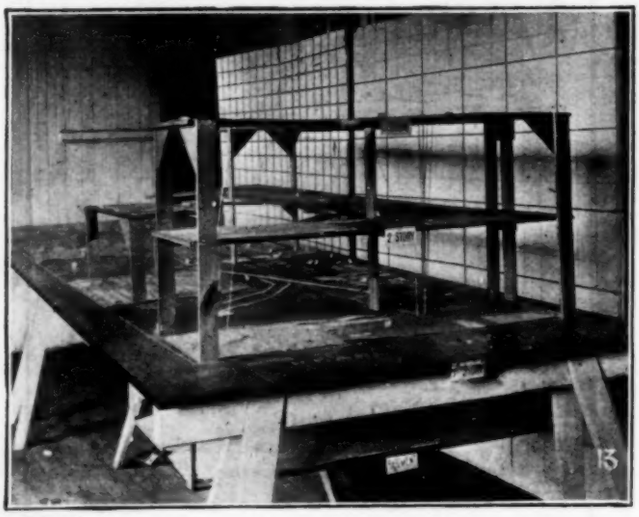
of the finished product. A circle circumscribing a number indicates that some operation has been performed on the piece. The number may designate either the operation or the operator. If the circle is smaller and incloses a capital *M* transportation by a man from one operation to another is indicated. If a lower case *m* is used the transporter is a boy, while if a number is used it shows that the moving is done by the workman performing the operation designated by that number.

Inspection for quality is shown by a diamond, inspection for quantity by a square. Overinspection for either by two diamonds or two squares, respectively, one inside the other. Finished product in storage ready to ship is indicated by a six-pointed star inclosed in a circle. These and other symbols used will be found in Fig. 7.

Stencils are used in connection with a special pen to form the various symbols. The pen and stencils are illustrated in Fig. 8 and their use in Fig. 9. Note that the pen is a sort of ink funnel which assumes a nearly vertical position when in use and easily follows the stencil holes. The same pen and another stencil are used for the standardized Gilbreth lettering which appears on both drawings in these two figures. The lettering stencil is in use in Fig. 9. Metal clips attached







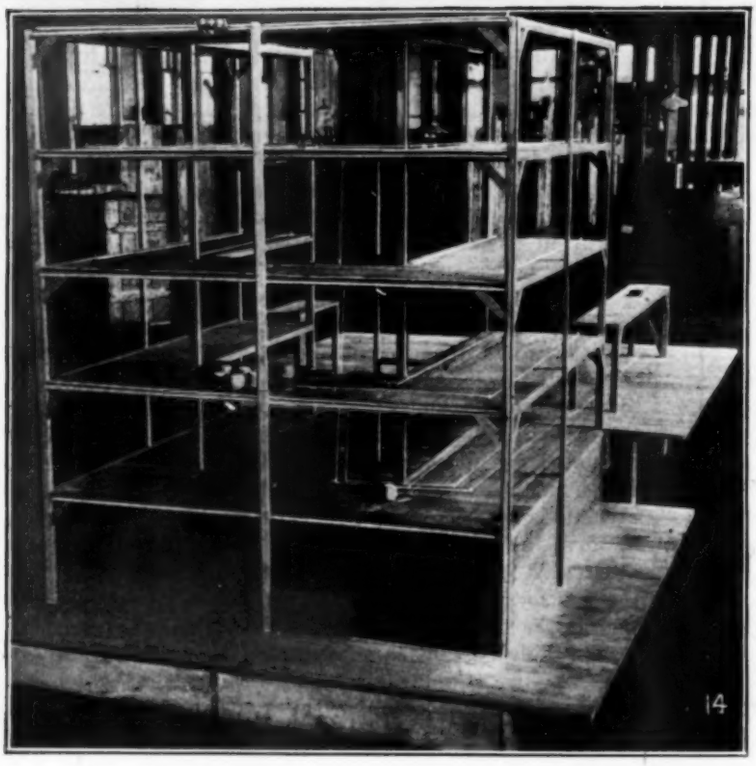


FIG. 10—SMALL PLANE ROUTE MODEL BEING MEASURED WITH MAP MEASURER. FIG. 11—A MORE ELABORATE SINGLE FLOOR ROUTE MODEL. FIG. 12—MR. GILBRETH STUDYING A SMALL ROUTE MODEL. FIG. 13—THREE-STORY AND BASEMENT ROUTE MODEL. FIG. 14—ROUTE MODEL OF FIVE-STORY FACTORY.

to the T-square serve to hold the stencils.

One other point might be mentioned and that is in regard to the size of the symbols. As will be seen in the illustrations the lettering is large enough to be read at a distance of some feet so that the charts can be hung up on the walls of an office. If the charts are needed in a smaller size it is a simple matter to make photostatic reductions to any desired scale.

If the discussion on any particular feature of a process chart reaches a deadlock it is a good plan to make use either of the stereoscopic photographic plates described in a previous article to bring out the exact details of the operation or even to project a motion picture film of the job on the wall of the room where the meeting is held.

Data recorded by the process chart and the camera are useful in standardizing the

work of a plant. They also give desirable information when functionalization is under consideration, but to a lesser degree. A better tool for the latter purpose is the organization chart.

There is nothing new about the organization chart. It has been in use for years and many futile attempts have been made to make it run plants. Unfortunately it is not a substitute for brains, ability or initiative. Its function is to indicate the responsibility of each executive by showing which men report to him and which one or ones he reports to. So much has been said and written about organization charts that it is unnecessary to show any here. Incidentally Mr. Gilbreth is quite frank in saying that he has never yet seen or been able to work out an entirely satisfactory organization chart. The personal element is a factor so vital and so variable that the best organization chart may be obsolete in three months.

Route Models

A not unimportant place in the Gilbreth plan is occupied by the route model or path chart. The process chart gives a picture of what happens to the piece or assembly under consideration and shows the various stations at which the operations are performed. Its function is chronological in that it puts operations in their proper sequence. It cannot, however, give any real picture of distance or the physical relations between the parts of the plant in which the various jobs are performed.

The function of the route model or path chart is to show how far and in what direction the work must move from operation to operation and from department to department. Most men who have had to plan work have probably made use of small-scale paper patterns in some way or other. In the case of laying out machines in a shop the patterns are floor plans of the various units cut out to the same scale as the floor plan so that they can be shifted about, until the best arrangement has been found. They can then be pinned or pasted in position and the layout plan drawing prepared from the result.

Perhaps the simplest form of path chart is to take such a layout and trace the path of the work from machine to machine and from bench to bench by means of colored thread and pins. Nothing more elaborate is really necessary if the whole process is performed in one room. Such a chart made on cross section paper is shown in Fig. 10. The instrument in the hand of the engineer is an ordinary map measurer used for scaling distance.

A much larger route model is shown in Fig. 11. In this case the path of the work has been plotted in ink. Still another one appears in Fig. 12 which shows Mr. Gilbreth at his desk making notes as he studies the route model and devises ways and means of shortening the process under consideration. In this one, partitions and columns are shown in place to give a clearer picture to the investigator.

When the work passes from floor to floor of a multi-story building a three-dimension route model is a big help in studying the process. A model for a three-story and basement building is shown in Fig. 13 and one of a five-story building in Fig. 14. The completeness of such models depends on the skill of the builder and the amount one cares to spend on them. Note in Fig. 13 the group of threads coming down the elevator shaft just to the right of the cards designating the upper stories.

Allowable Live Loads in Buildings

RECENTLY there were completed a survey of the floor conditions in the Equitable Building, New York City, made at the request of the Building Code Committee of the United States Chamber of Commerce. The successful completion of this work is another step toward standardization and it is hoped that from it as a beginning standards of building code requirements for allowable floor loads will result.

The Building Code Committee is endeavoring to secure all possible information of actual floor load analysis or calculations upon every kind of occupancy, including machine shops and public garages. It is anxious to receive copies of existing reports of floor load studies and hopes that surveys will be made in a number of plants using machinery.

The following paragraphs are an abstract from the report of the study made at the Equitable Building:

The objects were to determine the maximum, minimum and average floor loads existing in actual office practice; the nature and distribution of such loads; and the relations which they should bear to the assumptions for design of floor slabs, floor beams and columns as governed by prevailing building code practice. With this in mind it was necessary to determine the actual weights of office furniture and merchandise, also its location with reference to partitions and floor beams.

Three floors were selected, representing light, medium and heavy classes of occupancy, and the entire area of these floors was surveyed. A force of five men equipped with platform scales and field book spent several days weighing and tabulating every article of furniture within the areas mentioned.

Sketches were prepared for each office, showing the location and weights of all articles of furniture, so that the distribution of loads could be quite closely determined. The results form a most interesting and valuable collection of data:

MAXIMUM, MINIMUM AND AVERAGE LIVE LOADS IN EQUITABLE BUILDING

	No. of Offices	Maximum Lb. Sq.Ft.	Minimum Lb. Sq.Ft.	Average Lb. Sq.Ft.
Light occupancy floor (20th)	67	55.4	0.87	10.26
Medium occupancy floor (37th)	64	30.73	3.27	10.67
Heavy occupancy floor (11th)	62	33.84	5.00	13.96
Total and Average	193			11.6

The weights given do not include radiators, which averaged 200 lb. each, with two to each bay, located under the windows. These would add approximately 1 lb. per square foot for all exterior bays.

The weight of the partitions was not included in the calculations. These in general are 3 in. hollow tile plastered each side, and a careful weighing of one which was being removed showed a weight of 30 lb. per square foot, or approximately 350 lb. per running foot. The weight of occupants, taken at 150 lb. per person, is probably high.

The careful sketches of load arrangement made it possible to throw some light on the prevailing method of assuming uniformly distributed live loads as a basis for floor design, and help to indicate what relation such assumptions should bear to actual total loads.

Examination of bays for which the live load was more than 25 lb. per square foot, showed wide variation in the distribution of such loads. The larger proportion was found, as might be expected, within a zone approximately

3 ft. wide around the walls, the remainder being distributed variously in the center of the rooms. In one or two cases, however, the major proportion of all the load was situated away from the walls and this condition must be provided for by designers. There is also the porobability that practically all furniture may be collected in the central portion of a floor area when occupants are moving, or when painting or cleaning is in progress.

Examination of all the floor sketches shows but eight articles of furniture (safes) over 2,000 lb. in weight. A number of sectional filing cases and bookcases with contents weighed much more, but these weights were distributed over such a large area that they could not be regarded as concntrated. Of 36 safes and safe cabinets, 23 weighed less than 1,000 lb., 5 between 1,000 and 2,000 lb.; 2 weighed 2,200 lb.; 2, 2,360 lb.; 1, 2,800 lb.; 1, 3,000 lb.; 1, 3,500 lb.; and 1, 4,250 lb. This seems to indicate that if care in regulation of occupancies were exercised, considerable economies might be possible in providing for concentrated loads. To what extent such regulation is practical is a matter for deliberation.

As would naturally be expected, the live loads were found lighter next the outside walls. Single row filing cases, cabinets, safes, bookcases and bins are usually located against blank interior walls. Whether by accident or otherwise, the heavier loads were not found where partitions cut up the floor space into small rooms, indicating that allowance may not be necessary both for removable partitions and heavy floor loads.

Several instances were found where two adjacent floor bays supported average loads of 25 lb. or more, but in no case were two adjacent bays found in excess of an average of 40 lb. per square foot.

There are but two or three instances in the floor plans discussed where three offices or store rooms meet at the same column and it is probable that this condition will be found but rarely in buildings designed for a sufficiency of light and ventilation. In view of this and of the surprisingly light average floor loads discovered, it becomes an interesting question whether in a building of this type further reduction in loads assumed for column design could be made with safety. The building was designed for a live load of 100 lb. per square foot on the first floor and 75 lb. on all others.

Other investigations have been made, some by the Committee and some by individual engineers, so that the data available include more than the information gained from the Equitable test. But the total is lamentably small, and all who can and are willing to supply reliable information of this sort are strongly urged to report it to the Committee's office at the Department of Commerce in Washington, D. C.

Brains versus Hands

By F. P. Terry

I have read with interest the contribution of O. C. Richards under the above heading on page 929, Vol. 57, of *American Machinist*. While I agree that many of his views are well worth the careful attention of machine shop foremen, the article left the impression on my mind that we should look upon the brains and hands as separate items in the foreman's make-up, and that the foreman who wishes to be successful should leave his hands at home. It is some thirty years since I first blossomed out as a machine shop foreman and a reader of this journal. Since that time, conditions have changed very much, but I am firmly convinced that the cunning of the hand is as necessary today in many ways as it was thirty years ago, as far as the foreman is concerned, if he is to keep his self-respect and that of his workers.

One evening a few days ago, I called upon an old friend who owns a large joinery works, and I was somewhat surprised to see him with coat off and sleeves rolled up, hard at work at one of his benches. After a few minutes we adjourned to his office, and naturally I was anxious for an explanation.

"Well, Terry," he said, "You see those things over there. A few days ago I contracted for seventy of them, estimating the joiners' time at six hours each. Yesterday five men started on them, and when I came in last night at stopping time they had each completed one in eight and a half hours. Speaking to the foreman about it and finding that he considered that they had done well, I fired him on the spot, and this morning I raked out as many old tools of mine as I could find, took off my coat and started in.

"'Going to show us up, I suppose,' said the shop steward.

"'Nothing of the sort,' I replied, 'I am going to show myself up, and if I do I'll make the lot myself as a punishment.'

"I completed one in five hours, while each man had one completed in six. My second is nearly finished, and the men are trying their best to catch up with me. A half an hour in the morning will see me leaving the job to them entirely."

While this true story did not occur in a machine shop, almost every foreman sometime or other comes up against similar instances, and like my friend, must buckle to and "show himself up" or lose the respect of his employers and the men.

The Foreman's Skill in an Emergency

One morning in the early days of the war, the erecting shop foreman came to me just after the breakfast interval in great distress. His crane-driver had refused to go up on the travelling crane without a substantial increase of wages, the reserve man was out ill, and would I come and talk him round. "No," I said, "just pay him off, and I will be down in a few minutes."

Before the dismissed driver was hardly outside the gates, the crane was functioning as usual, but the superintendent was in the box. For two hours I manipulated it alone and then got a bright youth up beside me. On coming back after the dinner interval I was accosted by the self-discharged craneman wanting his job back; but I informed him that he had better see his foreman, as I did not start any hands and I believed his job was already filled. The next day he was restarted on condition that he complete the education of the bright youth, who was afterwards given a better job down below. There is nothing marvellous about this, but a simple case of my hands retaining their cunning.

Of course, there is something seriously wrong if the foreman is called upon for stunts of this sort every day, but I strongly advise every foreman not to neglect this side of his business if he desires promotion, as the higher he goes the more useful becomes the cunning of the hand, if only to "show him up."

If we study the early history of the machinist trade we find that the cunning of the hand predominated. Education even to the extent of learning to read and write was difficult, while today matters are reversed.

Mr. Richards' remarks may have been intended only for the foreman here and there who overdoes the physical side of his duties. However, it would be unwise to forget that the foreman is primarily a leader of men and boys whose existence depends principally upon the cunning of their hands, and if he lacks this knowledge, progress in his shop will be slow.

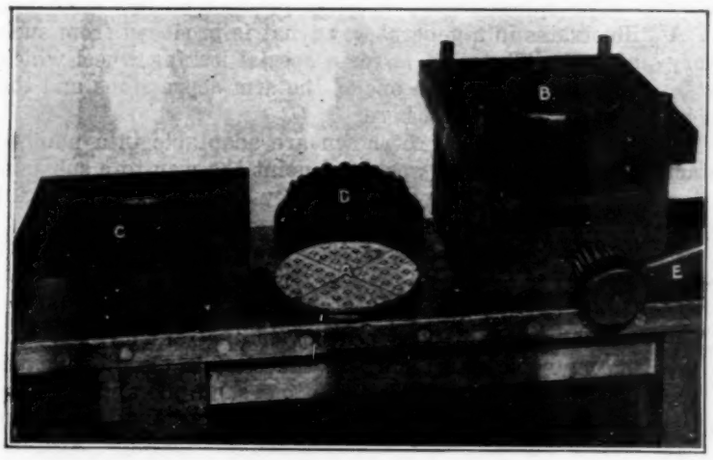
Die-Sinking Under a Drop-Hammer

By FRED H. COLVIN
Editor, *American Machinist*

A method which saves time and money and helps to reduce cost of die castings—An adaptation of silverware methods to another field

ONE OF THE essentials of successful die castings is to have the dies properly designed. Next comes the making of the dies, and on the cost of these dies depends, to a considerable extent, the cost of the castings which they produce. Both of these phases of die casting, the designing and making of the dies, have been given very careful attention by the Atlas Die Casting Company, Inc., Worcester, Mass., of which Nathan Lester, chief engineer, has devised a method of making dies at a minimum cost.

Two striking examples are shown in Figs. 1 and 2, of dies for casting electrically heated irons for making the delectable waffle, in either the round or rectangular shape. One of the waffle iron castings is shown in Fig. 1 at *A*, the die at *B* and the backing plate, or plain side of the die at *C*.



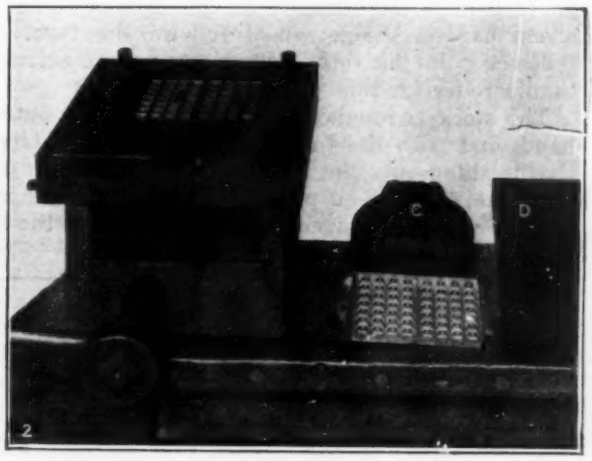


FIG. 1—A ROUND WAFFLE IRON MOLD. FIG. 2—ANOTHER TYPE OF MOLD

The making of the dies by the usual methods of die sinking is an expensive operation as the rectangular dough pockets would have to be worked out after drilling the holes as large as possible. But instead of doing this, Mr. Lester has taken a leaf from the practice of die makers in the silverware business and made the dies at a very low cost.

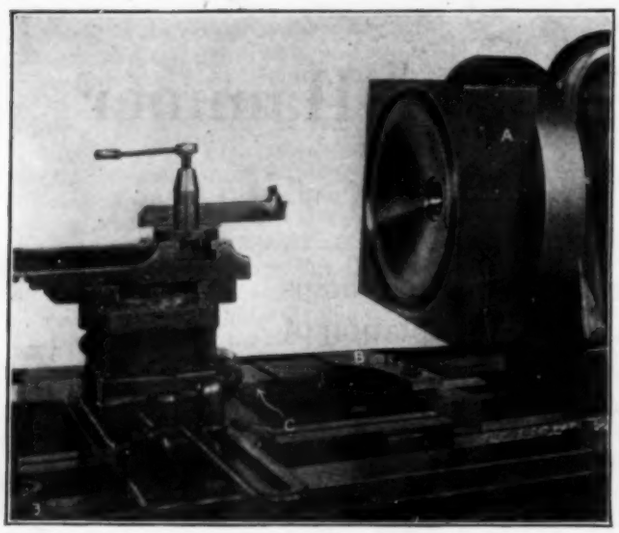
Instead of digging out the holes he made a hob or force as at *D*, by turning up a blank of the right size. Then he made the teeth or prongs by milling across the face of the hob with the proper cutter and the correct spacing to form the points which duplicate the waffle iron. The small, partly spherical depressions were made under a drilling spindle. The hob was then heat treated.

The die blank *B*, which was afterwards inserted in the mold as shown, was turned to a diameter about ½ in. larger than the finished mold and somewhat less in thickness. The blank was then heated to from 1,500 to 1,600 deg. F. In the meantime the hob had been fastened in the drop head of a husky drop hammer by pins at four points and the hammer raised to its full height. The heated blank was placed under the hammer and the head dropped. One drop usually drives the hob in to the full depth but occasionally a second drop is necessary, either with or without re-heating.

It seems hardly credible that steel will stand such treatment but the facts remove all room for doubt. The metal in the blank was forced out around the edges to some extent and also upward, hence the allowance for finish turning the outside. The surface was finished by grinding and but 0.012 to 0.015 in. usually had to be ground off.

After finishing and heat treating the die was ready to put into service. The steel used was a high grade chrome-vanadium alloy. Before casting, the cover was put in place on the four guiding posts and clamped in the machine. The handle *E* operates the long pinion which lifts the stripper plate for separating the mold and removing the finished castings.

Another type of waffle-iron mold is shown in Fig. 2. Here the die is in two sections *A* and *B*, each being made by the hob *C*. The back plate is at *D* and the stripping device is the same as in the first die. The making of the hobs or forces is a comparatively simple matter as they are practically plain milling-machine work which can be done by a boy who has acquired a little skill at the milling machine.



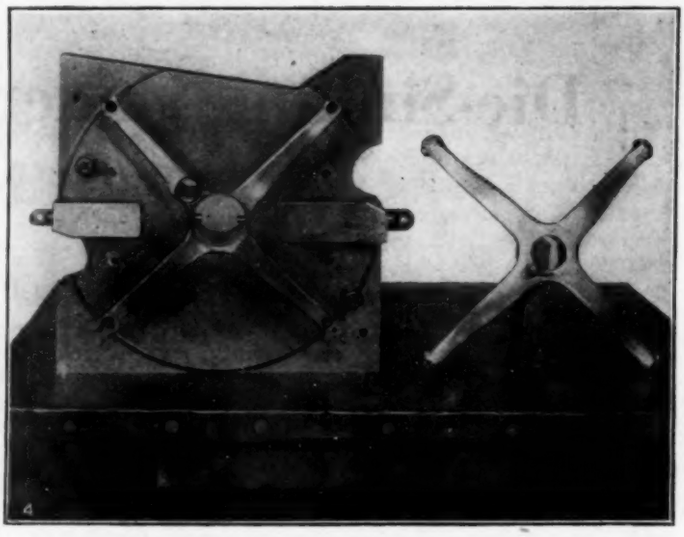


FIG. 3—TURNING A CURVED FORM. FIG. 4—MOLD FOR DIE-CASTING A SPIDER

Another type of die and a clever way of making it is shown in Fig. 3. This die is for an automobile steering-wheel spider as illustrated in Fig. 4. The steel block *A* is mounted on the face plate of the lathe and the formed guiding plate or cam *B* is bolted across the lathe bed. This form is carefully laid out and cut in a heavy steel plate which is then hardened. The follower point *C* is attached to the toolblock and has a sharp hardened edge which follows the form *B*. A follower point has been found much more satisfactory than a roller for this work.

The stock is roughed out by following the outline by hand, and with the follower point out of contact. On the finishing cuts the follower point is held in contact with the form at all points. For making the mating piece, the form is turned over and bolted to the bed on the other side of the carriage. The follower point is also attached to the other side of the toolblock. In this way no trouble is experienced in securing two surfaces that fit each other and which form the parting line for the main part of the spokes of the wheel. The mold for the spokes is cut into the male part of the die as seen in Fig. 4.

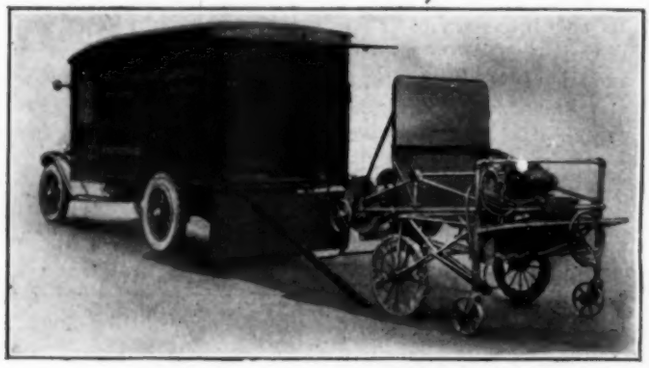
The spider shown is not a product of this mold but illustrates in a general way what is produced from such a mold. The mold is for a special locking wheel which explains the hole in one of the arm depressions and the pins in the central bore.

The methods here shown are adaptable in a number of other kinds of work and point the way to a substantial saving in many cases. They are well worth careful study and experiment.

Bringing the Demonstration Home to the Foundryman

A rather unique method of educating foundrymen to the advantages of the sand-cutting machine has been adopted by the American Foundry Equipment Co., New York, N. Y.

A specially built commercial body on a Dodge chassis is used to transport a standard sized sand-cutting machine about the country from foundry to foundry where it is to be demonstrated. The complete outfit can be seen in the accompanying illustration. The sand-cutting machine is "dropped off" at the foundry door, the power cable plugged in on the electric circuit, and the machine is ready to trundle to a sand pile and pitch in. There is no guessing, nothing assumed, nothing taken for granted, about this method of selling. Skeptics have their doubts disproved or confirmed on the spot.



THE TRAVELING DEMONSTRATION OUTFIT

The machine itself was described on page 649, Vol. 56 of *American Machinist*. A number of blades, mounted in cylindrical form, revolve rapidly, and as the machine moves slowly forward astride the sand heap these blades blend the sand and disintegrate the lumps. The machine travels under its own power with the operator guiding it.

This demonstrating car has been traveling in the Middle West for several months. There is no cost to the foundryman for the service, and no obligation. The schedule for an extended trip this spring is now being prepared to give demonstrations wherever they are desired.

Census Figures on Babbitt Metal

The 1922 census of manufactures showed that the value of babbitt metal and solder products decreased 55.5 per cent from 1919 to 1921, but that the increase for the period from 1914 to 1921 is 36.9 per cent. Ninety-eight establishments reported products valued at $5,000 or more.

Co-Ordinating the Bill of Materials With Shop Requirements

BY G. G. THOMPSON

Intelligent sub-assembly grouping and numbering simplifies shop methods—Card file more flexible than materials sheet—Chances of error and waste reduced

NUMEROUS articles have been written on the subject of manufacturing activity and its various functions coming under the category of planning, routing, scheduling, material control, time study, etc., but very little has been said regarding the importance of co-ordinating engineering specifications with actual manufacturing conditions. Intelligent, accurate and efficient application of manufacturing effort is largely dependent upon the methods of the Engineering Department in presenting data to the shop. It is a foregone conclusion that the issuing of specifications or a bill of materials as well as drawings, must precede the manufacturing of a complete machine.

A perpetual problem confronting the engineering department when making up specifications is the listing of various units by groups, in such manner that when these units are assembled the result will be a complete sub-assembly of the main machine. Of course, there are many sub-assemblies that are extremely simple and require no great degree of skill in the grouping of the component parts on the specifications. Sub-assemblies that are simple as viewed by the designing engineer, and would appear as a logical grouping on the specifications, however, are oftentimes found impractical in the shop. Especially does this condition manifest itself in a plant where the products are not completely standardized and where to make a sale the product is clothed with special features in its mechanical make-up to satisfy the desire of each customer.

Annoyance of Altering Specifications

A source of great annoyance is met in the changes, additions, cancellation, etc., of units on the specifications after the orders have been issued to the manufacturing departments. It is the purpose of this article to describe a method by which specifications as they are received from the engineering department can be rearranged to harmonize with the practical method of assembling or erecting as performed in the shop, at the same time reducing time and expense to a minimum where changes, additions or cancellations are involved during the process of manufacturing.

It would be well to mention here that a sub-assembly is a combination of units put together, preparatory to using it on the main or final assembly of a complete unit. In other words, many of the final assembling operations in machinery manufacturing are preceded by a certain amount of sub-assembling.

As mentioned before, we cannot depend upon the specifications from the Engineering Department being accurately grouped into sub-assembly divisions. Therefore, we will consider, for convenience, that these specifications as received from the Engineering Department constitute a *material list* only. This list, although inaccurate in the grouping of units for sub-assemblies, is nevertheless correct in the listing of the total amount of materials required. A copy of this material list is sent to the stores office, another copy to the erecting or assembly foreman, and a third copy to the time-study department, if there is one. The stores office proceeds to enter individual manufacturing orders from the material list. The individual units thus manufactured, as far as consistent, are routed to the finished storeroom to be held until the assembly foreman calls for them.

Separate Orders for Sub-assemblies

In many plants the assembly foreman when ready to start assembling would order the storeroom attendants to deliver all of the material listed on his copy of the material list. These materials would all be charged to one manufacturing order number. This number would also be the same as the one to which the erectors and assemblers would charge their labor time, because of the fact that no separate order numbers were issued for sub-assembly operations. The result of this condition is that the storeroom delivers all of the material to the erecting floor creating a conglomeration of materials from which the erectors and assemblers are compelled to pick out the units necessary for the various sub-assemblies.

Not only is considerable time and expense lost because of this sorting, but, in addition, there is no method by which the cost department can determine the costs of certain sub-assemblies that may be required for repairs. Refinement of cost records for reference in the event of contemplated changes would also be lacking. Orderly appearance of the assembly floor would be sacrificed.

Contrast these conditions with those in a plant where manufacturing orders are issued for each sub-assembly. The assembly foreman requisitions only such materials as are required for each respective sub-assembly. No congestion is experienced on the assembly floor. The fact that separate order numbers are assigned to each sub-assembly provides the cost department with tangible evidence of unit costs.

In a plant where a time-study department is func-

tioning, the time-study man who is making the analysis of sub-assembly operations for the purpose of setting rates, usually has plenty of time when making observations to compile a list of the units constituting a sub-assembly and check them off on the copy of the material list received from the engineering department. In making up these sub-assembly lists it is well to enter after each item the page and line numbers on which that respective item is found in the material list received from the engineering department. In the event that no time-study man is available, the foreman must check off the items on the material list to show what materials constitute the respective sub-assembly.

Names and Numbers of Sub-assemblies

This checking of materials is done only on the first complete unit being built and serves as a guide to keep the sub-assembly lists up to date for use when building the same units in the future. It is of course important that each sub-assembly should have a name as well as a part number for identification. The *name* of the sub-assembly could be easily assigned by the erecting foreman. The assignment of a *number* to identify the sub-assembly is the next step.

After a complete check has been made on the material list of the parts making up the entire number of sub-assemblies, the sub-assembly lists as made up by the time-study man or erecting foreman are turned over to a person delegated to supervise the assignment of part numbers to sub-assembly. This person may be either the time-study chief, stores supervisor, or any intelligent person performing duties in the production office.

There are many methods of assigning part numbers to sub-assemblies, but the method as explained below is very successful and at the same time reduces to a minimum the possibility of indentifying the same sub-assemblies by two different part or assembly numbers. Instead of designating the number of a sub-assembly as a part number we will call it the assembly-number so as to differentiate more sharply between the part or piece number of a single item and the number assigned to an assembled unit.

Method of Assigning Part Numbers

The assembly number will consist of three distinct classifications, each classification being separated by a dash. The first classification represents the type of the unit, the second represents the code number of the assembly and the third identifies the assembly. For example, if operations are to be performed in the final assembling of a machine and the type of this machine is 28–J, the assembly number would read 28J–0–0, and is interpreted thus:

Type	Code	Identification
28J	0	0

When the zero is used in any part of the assembly number, it signifies "complete." Consequently the assembly number 28J–0–0 tells the story of the complete final assembly of the type 28J Machine. The sub-assemblies, however, are identified by numbers in place of the zeros and if such sub-assemblies are used on the type 28J machine, the first number of the assembly number will always be 28J.

The next step will be to make up a list of names that will be used in the sub-assemblies regardless of the type of machines on which these sub-assemblies are used and assign to each name the code number which will be used as the center figure of the assembly number. Thus:

Code	Name
1 — Bases;	.....Base Plates; Drill Press Base.
2 — Frames;	.....Motor Frames; Car Frames.
3 — Shafts;	.....All Kinds.
4 — Levers;	.....All Kinds.
5 — Clutches;	.....All Kinds.
6 — Brackets;	.....Bearings, Housings.
7 — Bands	
8 — Guards	
9 — Pulleys; Wheels; Rollers; Sprockets; Gears; Etc.	

At first glance it would appear that any attempt to classify code numbers, as in the above, would form a list that would be too long and result in complications. The fact is, however, that less than forty code numbers will answer the purpose of a large majority of concerns. The names are practically standard and have a wide flexibility in their application as will be explained later.

This list when made up should be the first sheet in a loose-leaf book. At the top of the page the title "Code Numbers" should be written. Underneath, in numerical sequence, should appear the code numbers together with the respective names. Any new names added to the code will be assigned the next open number running in sequence.

Details of the Book

For every code number there should be a page inserted in the book. In other words, Code No. 1 will be page one with the title "Bases, Base Plates, Drill Press Bases" written across the top of the page; Code No. 2 will be page two with the title "Frames, Motor Frames, Car Frames," written across the top of the page. If there are 20 code numbers there should be twenty pages in the book, each page bearing the respective title of the *page number which is the code number.*

Each page will have a series of numbers stamped on the left side in numerical order beginning with number one. These numbers are the ones to be used as the end number of the assembly number for identification. For example, one of the sub-assembly lists as made up by the time-study man or the erecting foreman might be named a Gear Guard Assembly. Referring to our code numbers we find that the code for guards is No. 8. As this guard is used on the type 28–J machine our assembly number would read 28J–8–?

So far, we know that 28J–8 tells us that it represents a guard to be applied on the type 28J machine. Now then, to determine what kind of a guard is to be assembled we must assign the end number to the assembly number. Turning to page 8 we find that no numbers have been appropriated for identifying guards. Therefore, number one will be the first number taken. After number one on page 8 will be written the name of the sub-assembly thus:

1 — Gear Guard.

Number one then becomes the end number of our assembly number which will read 28J–8–1. Thus we have the full interpretation of the assembly number in that:

28J = The type of the machine.
8 = The part of the machine.
1 = The identification of the part.

If a belt guard is used on this same machine the

assembly number would read 28J–8–2, providing, however, that number 2 is the next open number on page 8. Under all circumstances the code number (center number) remains the same regardless of the type of the machine or the design of the unit represented by the end number. If the gear guard assembly, No. 28J–8–2, is also used on a different type of a machine the assembly number should remain the same, unless there is a difference in the cost or in the materials, in which

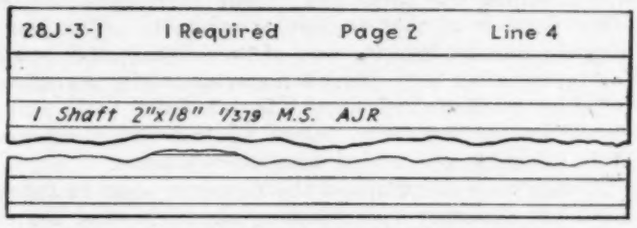


FIG. 1—FILE CARD FOR SUB-ASSEMBLY PART

case the assembly number should be changed in so far as the type is concerned.

Thus 32J–8–2 may be the same design of a gear guard as 28J–8–2, but due to the difference in the costs or the materials we cannot use 28J–8–2 for 32J–8–2. If more than one Gear Guard is used, however, on the type 28J Machine, and the design or cost is different, the next open number on page 8 would have to be used. In this event the assembly number would read 28J–8–3. Number 3 in this case might identify an Idler Gear Guard Assembly while number 1 as first assigned might identify the Driver Gear Guard assembly.

Any changes made in a sub-assembly which affect the cost or necessitate a difference in materials is noted by affixing a letter at the end of the assembly number. Thus 28J–8–2A represents the first change, 28J–8–2B the second change, etc. The flexibility of this method of assigning assembly numbers can readily be seen and furthermore there is the feature of comparisons automatically coming to the attention when appropriating the various numbers necessary to formulate an assembly number.

After the assembly numbers have been allocated to the various sub-assemblies, the sub-assembly list is given to a typist. For each item constituting an assembly the typist will make out one card record. The card may be plain ruled 4 x 6 or 3 x 5 in., the size

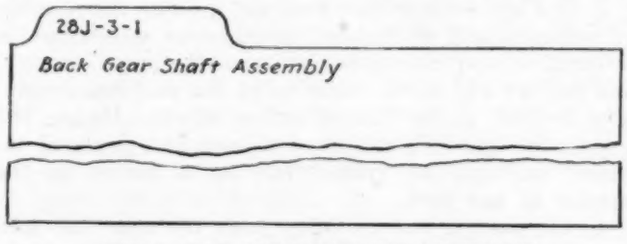


FIG. 2—TAB CARD FOR SUB-ASSEMBLY

depending on convenience. On each card should appear the following information:

The name of the part and material.
The quantity used on each machine.
The sheet and line number where found on the material list received from the Engineering Department.
Department routing of the part.
Drawing, pattern or piece number of the part.
The assembly number on which the part is used.
The number of assemblies required on each machine.

We will take for example the sub-assembly of a back-gear shaft, the assembly number of which might be 28J–3–1. The materials used in this sub-assembly we will assume are:

1 — Shaft 2"x18"
Pc. No. 1 Dwg. No. 379 Routing AJR
1 — Spur Gear
Pattern No. 379A Dwg. No. 379 Routing BJR
1 — Pinion
Pattern No. 481A Dwg. No. 481 Routing BJR
2 — Feath. Keys
½"x½"x2" Pc. No. 4 Dwg. No. 379 Routing R
2 — Setscrews
½"x2" Pc. No. 3 Dwg. No. 379 Routing R

As there are five different items listed, there should be five different cards filled out. The card for the shaft when filled is shown in Fig. 1. This arrangement is followed in making up cards for the other items.

Method of Filing Cards

After the five cards are made up, an index card, preferably 3-cut size, is made out with the assembly number 28J–3–1 typed on the tab and the name of the assembly typed underneath. (See Fig. 2.) The five cards together with the index card are then filed. The order of filing for indexing is numerical, first by the center number of the assembly number and then by the end number. The cards are filed under each sub-assembly division, first, according to the page number on which the item is found on the Engineering Department material list and then by the line number as noted in the upper right hand corner of the card.

The card in Fig. 1 as filled out is interpreted thus:

28J–3–1 = Assembly number.
1 Req. = Number of sub-assemblies required per machine.
Page 2 = Page on which the item appears on the material list received from the Engineering Department.
L—4 = The line number on page 1 describing the item.
1— = The required amount of shafts for *each* assembly.
Shaft 2"x18" = Name and size of item.
M.S. = The material (Machine Steel).
1/379 = Part number 1 on drawing No. 379.
AJR = Departmental routing in that A = Forge Shop; J = Machine Shop, and R = Finished storeroom.

When more than one sub-assembly is used, the amount is noted in the phrase "1 Req." by changing the amount accordingly. For example—if two sub-assemblies, No. 28J–3–1 are required on each complete machine, the phrase "1—req." would read "2—Req." The quantity of shafts, however, should remain one, because only *one* shaft is needed for *each* sub-assembly and if there are two sub-assemblies required it of course stands to reason that two shafts are needed. Under all circumstances the quantity specified in front of the name of the part should represent the requirements for *each* sub-assembly only. The quantity of sub-assemblies required will automatically take care of the total number of individual units needed on the complete machine.

After all cards are made out, grouped according to sub-assemblies and filed, we will find that there are

many items appearing on the Engineering Department's Material List which are not allocated to sub-assembly units. These parts are used only in the final assembly operations of the complete machine. Therefore, the orders as issued to the assembly floor will call for all of the sub-assemblies by their assembly numbers as well as the individual parts necessary to assemble the various sub-assemblies into a complete machine.

Card for Final Assembly Record

Since 28J–0–0 is the assembly number of the complete machine, consequently an index card bearing this number on the tab and the name "28J Final Assembly" written underneath, must be made out. One card for each sub-assembly must then be made out as well as one card for each of the miscellaneous parts, all of which are filed under 28J–0–0. Thus we have a complete record of sub-assemblies and miscellaneous parts that make up one complete machine filed in one group under 28J–0–0. The record of the individual parts that constitute each sub-assembly is found in the file under their respective assembly numbers.

This completes the arrangement of the material list in that the materials are grouped to harmonize with the actual assembly operations of the shop. In some concerns this method of formulating the bill of materials could be readily adopted by the engineering department, while in other concerns this would be impossible because of the necessity of maintaining old records. Consequently the method as outlined would have to be confined only to actual manufacturing activities for the convenience of the production office.

Apparently this procedure of grouping materials according to sub-assemblies, savors of red tape and large clerical expense. This is not so. The most difficult task is to make up the correct groupings. After that the maintenance of the records is extremely simple and efficient.

It will be noted that when any changes are made by the engineering department only the card or cards affected have to be altered. The rest of the cards remain intact. Here is where we encounter flexibility not found when the materials are listed on a sheet or more of paper. Only one or more cards are handled while with a sheet-list, one little change often means the rewriting of the entire list. If, for example, the engineering department issues a material list for the manufacture of 10 complete type 28J machines, one copy would go to the stores office and one copy to the person assigned to the duties of checking the material list with the cards as made out in sub-assembly groups.

Actual Procedure in the Shop

The stores office would proceed to check the material requirements with the stock, or issue stock orders to the shop for any shortages, using the material list as received from the engineering department. Simultaneously the checker is comparing item for item appearing on his copy of the material list and the sub-assembly cards in order to take care of any possible changes in the size, drawing number or pattern number of any individual unit.

As each sub-assembly is checked, the cards constituting the list of units of that respective sub-assembly, are given to a typist who assigns an order number and types the specifications or shop order. At the top of the sheet the name of the sub-assembly, together with the quantity for ten machines, the assembly number, and the order number is written. Underneath is then listed each item as found on the cards together with the total amount required of each item to complete ten assemblies.

A copy of this order is sent to the erecting foreman, one to the stores office and one to the planning department. At the request of the erecting foreman the stores attendant will deliver the items appearing on his copy of the sub-assembly order. The erectors or assemblers will assemble the parts and charge their time to the order number of that respective assembly. The planning department uses its copy of the sub-assembly order for information as to which materials to be manufactured on stock orders, should be scheduled to be completed simultaneously to insure against any shortages after assembly operations have been started.

Having once accumulated the necessary data to formulate sub-assembly specifications an interesting series of graphic charts can be drawn up showing the time taken for manufacturing each sub-assembly and which would prove of value in the planning and scheduling of the work through the shop.

Employee Suggestion Plans —Discussion

By Albert Clegg
Yorkshire, England

I WAS greatly interested in the article under the above title by Sanford De Hart, which appeared on page 365 Vol. 57, of the *American Machinist*, because it gave several expert opinions on the scheme in general and because actual figures were given as to the magnitude of the rewards various firms had thought fit to apportion for the ideas.

Personally, I have always been very keen about establishing the fullest confidence and co-operation between all grades of men in the machine shop. It has always seemed to me that much valuable gray matter was lying more or less dormant in the shop, and that it would be well worth while from the managerial point of view to go to any length in an endeavor to promote, and encourage, by every means in one's power, this same gray matter's co-operation in all branches of production.

It is a self-evident fact that the greater the number of technical and mechanical intelligences which can be brought to bear on a given problem, the more complete and perfect will be the solution of the problem eventually arrived at by the collective effort. Hence, the generation and inspiration of a keen and personal interest amongst all grades will be a factor in the success of any firm.

In the past, it has too often been the case that men have been curtly informed "You are not paid for thinking, you are paid for working," when they have ventured to suggest that in their opinions certain alterations were desirable in the interests of the firm. In many cases the foreman was the medium through which the man hoped to transmit his idea to the powers that be, and it was quite a regular thing for the foreman to be so jealous of his own position that he turned down the suggestion himself for fear the management might think him incapable. Under these conditions, the more useful the suggestion, the more likely it was to be turned down.

Now the suggestion box scheme, with its element of secrecy and impersonality, gets round this feeling of petty jealousy and, if properly organized, creates in the minds of the workers a feeling of confidence that any suggestion they might make will be given careful consideration. But a really good suggestion scheme goes further than this—one is not only assured of a careful consideration of one's ideas, but is also assured that, if adopted, full acknowledgment will be given and even should they not be adopted, the reasons for the non-adoption will be carefully explained. It is just as important, possibly more so, to explain why an idea cannot be adopted as to reward the ones that are adopted. The man who has made the unsuccessful suggestion will probably have spent just as much, or more, time thinking it out as the man who happens to make a successful one, and if his efforts are not shown to be appreciated, his natural disappointment will lead him to throw up the suggestion business in disgust.

Rewards Should Be Liberal

The most interesting portion of Mr. De Hart's article, is, in my opinion, the statistics relating to existing systems. Concrete figures are given showing actual rewards given by different firms. In one case, a young girl is stated to have made a suggestion which decreased the firm's cost of production by 25 per cent, while in another case 122 suggestions were acted upon, and the rewards amounted to $367.50. The said young lady received the whole of $50 for her idea. Now it seems to me that one of the fundamental principles of a suggestion scheme in that successful suggestees should be treated generously. Surely if a man originates an idea that saves anything at all, his reward ought to be as far as possible, proportionate to and regulated by the amount of saving it will effect. Does it seem equitable—does it not appear mean to reward an idea saving 25 per cent of the expenses of the whole place by a paltry $50? Is it not the reverse of generous to reward 122 suggestions with $367.50—three dollars per suggestion?

As previously stated, I have always had a lot of faith in the suggestion box idea, and I must confess that my faith is now considerably strengthened—if the suggestion box scheme will survive administration such as this, it is inherently sound and should be immediately adopted by everybody, as failure seems impossible. Of course, there is the honor, the knowledge of a thing well done, and all that sort of thing, but the fact remains that from the dollars and cents point of view, the reward is mean. If you are going to preach about the honor part of the business, well and good, but do not mix it up with mean rewards which should be beneath the dignity of any reputable firm to offer and certainly for the man to accept.

A Case in Point

Within the last few weeks a case has come under my notice that illustrates this point very forcibly. A certain firm of world wide repute has a small branch establishment doing similar work to the parent works. It transpired some time ago that on a particular type of job, of which there were large quantities to do annually, the branch shop was doing the work in about half the time taken by the main works, and close investigation brought to light the fact that one particular man in the branch shop was responsible for the very marked saving. The management of the main works asserted that the job could not be done in the time this man said it could, and as it had the same type, size and make of machines, and its time was (and always had been), slightly more than twice the time he gave, it was positive some mistake had been made. To prove that he could do the work, the man offered to do a sample, providing the management would leave him to himself until the job was finished. This was agreed to and the man proceeded to demonstrate that he was right and the management was wrong. Now this particular operator had not only thought out his idea, but he had actually applied it to his machine. It so happened that it was not prominent enough to attract the attention of anyone in authority, with the result that only he knew that the machine was any different from others of the same type. In addition to trying out the idea, the man had also provisionally protected it. The result was that when he eventually gave away the secret of the increased production, he was informed that the idea had been tried out at the head works years since and the drawings could be shown him to prove it. Whether this was true or not I do not know, but obviously, if the head works had tried a similar idea it had not been able to obtain the same results.

Rewards Should be Fair

Now I contend that a suggestion of this importance should have been dealt with as generously as possible. It should not have been the purpose of the management to try and prove it had a prior claim. Obviously, this could not be very well substantiated in view of its previous assertions as to the impossibility of doing the work in the time given. Its purpose should have been to reward the man according to the merits of the idea and further, to have given him a superior job in the head works, altering the remaining machines and seeing that they were run up to capacity when altered. As a matter of fact the man was very sore and talked about giving or selling the idea to two competitors, whose equipment, though different, could be adapted to the same principle. Incidentally it might be mentioned that a 50 per cent saving on the work in question meant thousands of dollars per annum on the wage bill alone, to say nothing of other savings.

Small Prizes on a Par with Cutting Piece Rates

I would earnestly advise every firm who adopts the suggestion scheme to be fair—if anything be more than fair. Let the rewards be based on the savings effected; let them be generous in amount, and the scheme will have a much better chance of success and yield much better results than if run under a mean, cheese-paring sort of a split-cent regime which can only eventually lead to disgust on the part of those from whom it is your mission to extract or coax suggestions.

A mean, niggardly, system of rewards is about on a par with the idea of rate cutting under piece or bonus systems. Any man who would cut a piece or bonus rate ought not to be allowed to manage a shop—he is not only cutting his own throat, but he is bringing the system of piece and bonus-work into disrepute generally, and making it much more difficult for *honest* men to start such a scheme. To my mind it is just as short-sighted a policy to run a suggestion system on a scheme of insignificant rewards, as it is to cut a piece rate because someone happens to be making a high rate of pay.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

Fitting Locomotive Crosshead Keys

BY F. M. A'HEARN

An unusual number of engine failures caused by the loosening of piston rods in the crossheads, resulting in broken cylinders or heads and all of the troubles attendant upon such failures, necessitated an investigation to determine the cause.

In most cases there was evidence that the key used to secure the piston rod in the crosshead body had become loosened while the locomotive was in motion and that the cotter *A*, Fig. 1, used to prevent the key from working out, was sheared off, allowing the key to be thrown from the crosshead and leaving the piston free

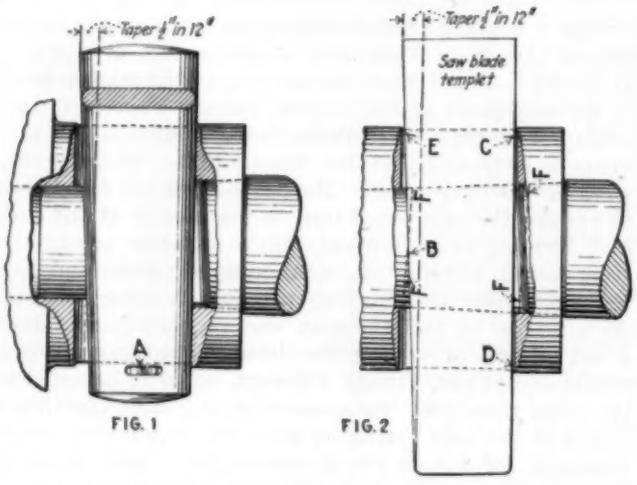


FIG. 1—PROPERLY FITTED KEY. FIG. 2—TEMPLET, SHOWING ERRORS

to be driven out through the end of the cylinder. In some cases the key would be bent, as if subjected to an excessive heat. In other cases the key was sheared a slight amount at the larger end and occasionally a key was found to be broken.

A number of reasons for the key failures were suggested; water in the cylinder of piston valve engines being most frequently mentioned. This would have been easy enough to believe were it not for the fact that piston valves had been in use for several years before any unusual trouble was experienced with loose pistons. Tracing the trouble back to the lathe hand who fitted the rods into the crossheads did not supply the answer as the taper fits were well made and did not appear to be at fault.

A harder grade of steel was tried on a few locomotives, and was satisfactory, which seemed to prove that the keys as formerly used were too soft. As, however, the so-called soft keys had been used successfully for several years, this apparent solution was not entirely acceptable and the entire process of fitting the keys was carefully gone over, disclosing the following conditions:

The keyways in the crosshead bodies were always cut at a right angle, to the centerline of the piston rods and the piston rod keyways were formed by drilling them in a jig which gave a taper of ¼ in. in 12 in. to all keyways. Therefore it was reasonable to assume that nothing was wrong with the work as it left the machine.

The temporary, or draw keys, used to draw the piston rods into the crossheads preparatory to fitting the permanent keys, were next subjected to investigation and afforded a surprise to all concerned for they were found to be mostly rough forged keys with tapers ranging anywhere from ¼ to 1¼ in. in 12 inches. After the piston rods were drawn into the crossheads by the use of one or more of the draw keys, the size would be measured with an adjustable gage and the permanent key machined to the sizes so determined. Examination of several of these keys showed that they were not all of uniform or standard taper, due to the fact that the bearing in the rod and crosshead body had become distorted by the use of the draw keys, and the permanent keys fitted to the distorted keyways in the questionable manner described.

A set of templets of the shape shown in Fig. 2 was then made and put into use and numerous cases were found where the bearing conditions were similar to those shown. A key might bear only at points *B*, *C*, and *D* and would not be in shear but would be subjected to a bending action. A slight bend sometimes brought the key into contact at *E*, which prevented it from being driven farther although the rod was not solidly held in the crosshead. A few rods were found with the taper of the keyway oposite to the taper of the key, as shown by the dotted lines *F*, *F*.

A cleanup of the matter was made by collecting all draw keys not machined on the edges, or with tapers other than ¼ in. in 12 in. All that could be salvaged were made over into the standard shape and all others were destroyed to prevent their future use. Machine operators making keys were given the templets with instructions to inspect each keyway and see that the bearing surfaces of rods and crossheads were in suitable condition before machining the keys. They were told that they alone would be held responsible unless their foreman was notified and the responsibility assumed to him. This practice was carried out, and fits like Fig. 1 insisted upon. The original key material was again used and the loose key troubles became a matter of history.

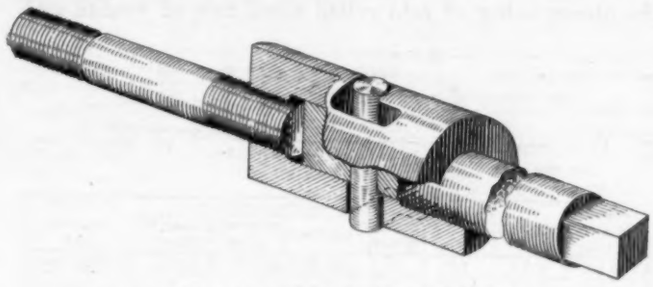
All of which goes to show that things are not always what they seem or as they are represented.

A Quick Acting Stud Driver

BY JOHN A. YUNGWIRTH

The quick acting stud driver described by Lee Jackson on page 1007, Vol. 57, of the *American Machinist*, reminds me of a tool that I made for a similar purpose some time ago.

As shown in the sketch, the driving member is a round bar of steel with one end hardened and the other suitably squared for a wrench. Before hardening the lower end a cross hole was drilled in it to fit the driving pin. The bushing has opposed L-shaped slots in it, as



A QUICK ACTING STUD DRIVER

I have tried to show in the sketch, and the driving pin is driven tightly into the cross hole after the bushing is in place.

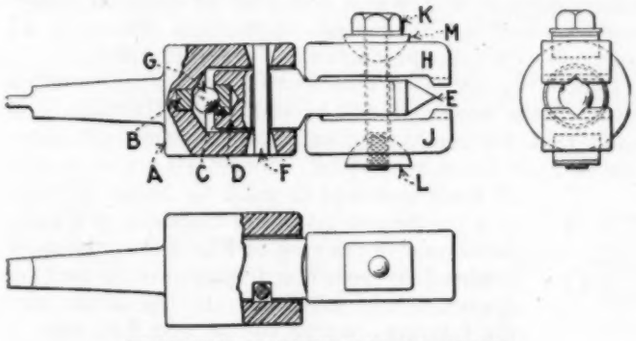
Besides being quick acting, this device has the advantage of being able to prevent careless work. While the tool is being turned forward the driving pin remains in the horizontal part of the slot and the end of the stud bears against the central member. When the wrench is turned back the pin must return to the vertical part of the slot and release the hold or the stud must unscrew, automatically indicating the setting.

If the latter happens it is ample evidence that the setting has not been properly done. The stud must be set tight or the driver will not let go.

Floating Holder for Reamers

By Jack Williams

The sketch shows a floating holder for use in the turret of a screw machine or in the spindle of a lathe, for holding the round shanks of chucking reamers or the squared ends of hand reamers. The body of the tool *A*, is made in one piece with the shank which can be made



FLOATING HOLDER FOR REAMERS

either taper or parallel in accordance with the machine in which is to be used.

A hardened pin, *B*, is driven into the body at the bottom of the bore and a similar pin *C*, having a concaved face, is driven in the end of the link *D*. A center point is turned on the outer end of the link at *E*, and a slot is milled across the link to engage the driving pin *F*. The ball *G* carries the endwise thrust.

Two clamps, *H* and *J*, rest upon the link *D*, and have V-shaped grooves in their ends to clamp plain round shanks. The bolt *K*, passes through clearance holes in the links and clamps, and is threaded into the oscillating nut *L*. The other oscillating piece *M*, is a washer and, with *L*, allows the bolt to adjust itself to the position of the clamps. The nut *L* is milled flat on the sides and fits into a pocket in the clamp so that it will not rotate.

Floating Reamer and Holder

By Harry J. Murphy

A reamer designed for use in a screw machine and arranged to float in a holder is shown in Fig. 1, together with a table of dimensions for such reamers from ⅜ to 1¾ in. in diameter, which probably covers the range of sizes required in screw machine work.

The fluted portion of the reamer is split in three or four places to allow for expansion by the taper-head

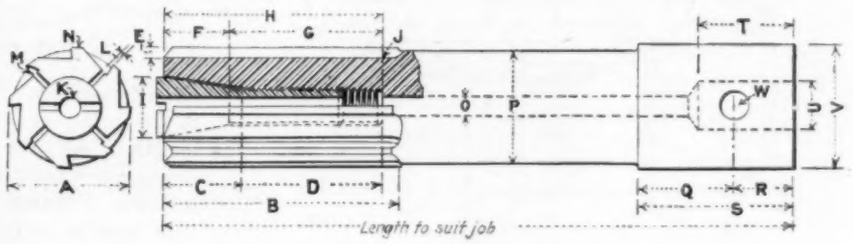


FIG. 1—ADJUSTABLE FLOATING REAMER

screw shown. The shank is 0.01 in. smaller than the hole in the holder, in which the reamer is held by a slip-fit pin through a transverse hole in the shank. A longitudinal hole through the reamer and expanding screw provides a channel for cutting lubricant.

The holder and adapter are shown in Fig. 2. The holder is made in two parts so that it can be brought into alignment with the machine spindle.

The method of setting is as follows: The holder and adapter are mounted in the turret and all screws and bolts loosened. A standard bar is chucked true with the spindle and the turret moved up so the adapter slips over the bar. The holder can then be locked in position by tightening the screws and bolts. A hole through the adapter is provided for the supply of cutting lubricant to the reamer by means of flexible tubing. The reamer and adapter shown provide a reliable equipment for accurate work in the screw machine, or turret lathe.

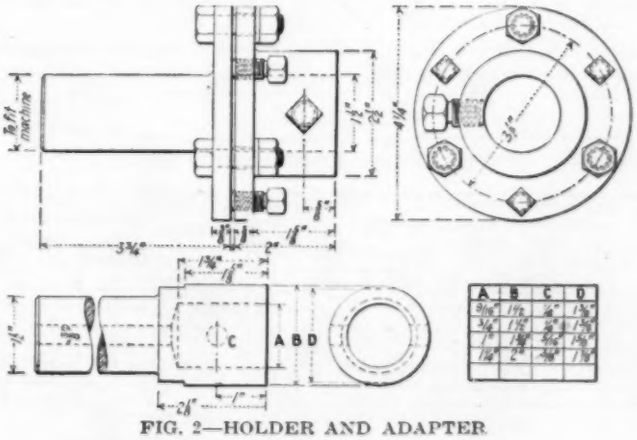


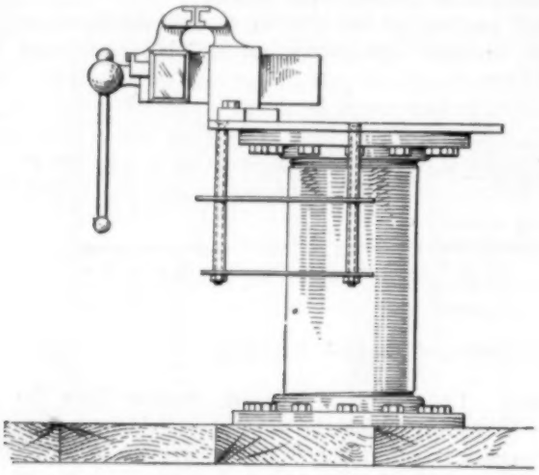
FIG. 2—HOLDER AND ADAPTER

A Dependable Vise Stand

BY F. M. A'HEARN

The vise stand here shown is intended for general use in connection with a group of machine tools and is so designed that it cannot become a repository for useless odds and ends and an eyesore to the shop, as do so many wooden benches that are given over to general service instead of being kept for the exclusive use of one workman.

The foundation of the bench is a piece of 10-in. pipe with a cast-iron flange at each end. The top is a piece of ¾-in. plate, 24x34 in., riveted or bolted to the upper flange. The shelves are of ¼-in. sheet metal suspended from the top plate by ½-in. bolts and separated by bushings cut from ½-in. pipe.



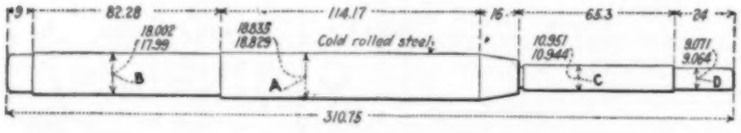
FLOOR STAND FOR VISE

This stand offers no place for rubbish to accumulate and the metal top does not commend itself to tired workmen as a roosting place, therefore it may be kept in reasonable readiness for immediate service.

Grinding Data on Cream-Separator Work

Through the courtesy of Theodore H. Miller, Works Manager of the De Laval Separator Co., Poughkeepsie, N. Y., we are able to present six interesting examples of grinding practice that show an accuracy of production which may surprise those not familiar with this kind of a product. While a cream separator hardly comes under the head of agricultural machinery it is unquestionably a machine to be used by farmers so that it must be simple in construction and at the same time be strong enough to withstand any stresses put upon it. The accuracy is indicated by the following examples:

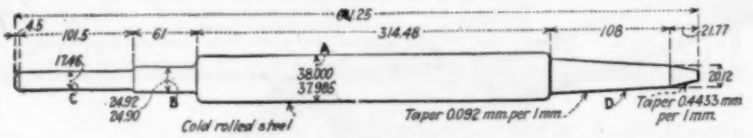
Considerable variety in material is shown, three of the pieces being of cold rolled steel, two of bronze and one of cast iron. The dimensions vary from 310.75 mm. to 18 mm., or approximately from 12⅜ to ¾ in. in length. All the dimensions excepting those of the grinding wheel, column 6 of the tables, are in millimeters. Figures in column 6 are in inches. Incidentally this may be a good time to correct two erroneous impressions; first, that any part of this separator is made at the home plant in Sweden and second, that the use of the metric system was forced, or even requested, by the home company. In fact the American company began by using English measurements and it was not until the metric system had been in use for about five years that the Swedish company knew that any change had been made.



OPERATIONS LISTED IN ORDER WORKED	AMOUNT OF STOCK REMOVED	TOLERANCE	PRODUCTION PER HOUR	PIECES PER DRESSING OF WHEEL	GRINDING WHEEL DATA: DIMENSIONS	MORTON WHEEL GRADE	SURFACE FT. PER MIN.	TYPE OF MACHINE USED
Rough Grind A	0.30	0.02	83	100	12"x 2"x 5"	660-R Nor. VE	6,000	No.10 B&S. Plain
" " B	0.30	0.02	110	200	12"x 1"x 5"	"	"	"
" " C	0.30	0.02	103	300	12"x 1"x 5"	"	"	"
Finish " D	0.50	0.02	144	150	12"x 2"x 5"	"	"	"
" " B	0.07	0.01	114	100	12"x 1"x 5"	"	"	"
" " A	0.07	0.01	83	150	12"x 2"x 5"	"	"	"
" " C	0.07	0.01	115	200	12"x 1"x 5"	"	"	"

Dimensions in mm Except Wheel Size

FIG. 1—COLD ROLLED STEEL SHAFT



OPERATIONS LISTED IN ORDER WORKED	AMOUNT OF STOCK REMOVED	TOLERANCE	PRODUCTION PER HOUR	PIECES PER DRESSING OF WHEEL	GRINDING WHEEL DATA: DIMENSIONS	MORTON WHEEL GRADE	SURFACE FT. PER MIN.	TYPE OF MACHINE USED
Rough Grind A	0.60	0.02	19	25	18"x 2"x 5"	660-R Nor. VE	6,000	No.12 B&S. Plain
" " B	0.60	0.02	40	50	"	"	"	"
" " C	0.60	0.02	32	50	"	"	"	"
" " D	0.75	0.02	50	50	"	"	"	"
Finish " D	0.07	0.02	50	50	"	"	"	"
" " C	0.07	0.01	33	50	"	"	"	"
" " B	0.07	0.02	40	100	"	"	"	"
" " A	0.07	0.01	17	25	"	"	"	"
" " E	0.07	0.02 TRUE TAPER	27	50	"	"	"	"

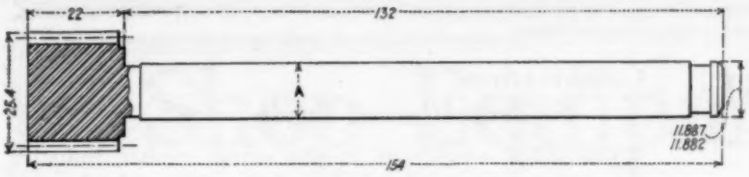
Dimensions in mm. Except Wheel Size

FIG. 2—A SHORTER SHAFT

It will be noted that the tables given apparently contain about all the information that could be asked for in connection with the pieces being ground. The data includes the grinding operations in the order in which they are performed, the amount of stock removed, the tolerance, production per hour, the number of pieces turned out for each dressing of the grinding wheel, full information as to the size and kind of grinding wheel used, as well as its surface speed, and the make of machine on which the operations are performed.

Before beginning to read and digest the information given in the tables, it will be well to fix thoroughly in mind that for most practical purposes the millimeter can be considered as 0.04 in. Considering the amount of stock removed it must be borne in mind that the figures given are fractions of a millimeter and in the case of Fig. 1 that the stock removed by rough grinding is 0.30 mm. or approximately 0.012 in. In the same way, the tolerance works out so that 0.02 mm. is approximately 0.0008 in. and 0.01 mm. is 0.0004, approximately a half-thousandth.

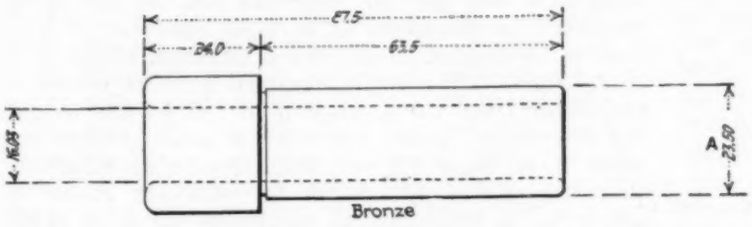
The six tables accompanying this article contain full and complete data regarding the grinding of the parts shown in the outline above them. The information, which can be gleaned at a glance should prove particularly useful to all those having grinding operations that in any way approximate the ones given in the examples shown.



OPERATIONS LISTED IN ORDER WORKED	AMOUNT OF STOCK REMOVED	TOLERANCE	PRODUCTION PER HOUR	PIECES PER DRESSING OF WHEEL	GRINDING WHEEL DATA			TYPE OF MACHINE USED
					DIMENSIONS	NORTON WHEEL GRADE	SURFACE FT. PER MIN.	
Rough Grind A	0.35	0.02	102	300	12"x 2"x 5"	5650-H Alun. Vit.	6,000	No.10 B.&S. Plain.
Finish "	0.07	0.01	109	200	12"x 2"x 5"	"	"	"

Dimensions in mm. Except Wheel Size

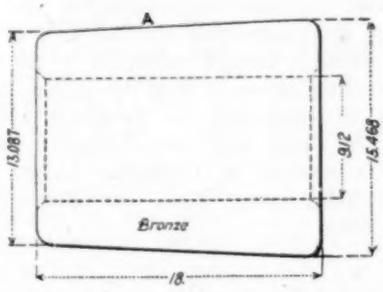
FIG. 3—STEEL PINION SHAFT



OPERATIONS LISTED IN ORDER WORKED	AMOUNT OF STOCK REMOVED	TOLERANCE	PRODUCTION PER HOUR	PIECES PER DRESSING OF WHEEL	GRINDING WHEEL DATA			TYPE OF MACHINE USED
					DIMENSIONS	NORTON WHEEL GRADE	SURFACE FT. PER MIN.	
Finish Grind A	0.15	0.02	77	100	12"x 2"x 5"	5650-H Alun. Vit.	6,000	No.10 B.&S. Plain

Dimensions in mm. Except Wheel Size

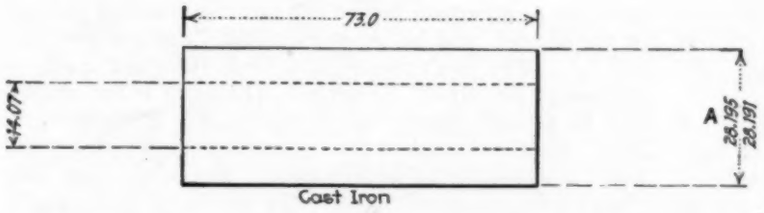
FIG. 4—BRONZE BUSHING



OPERATIONS LISTED IN ORDER WORKED	AMOUNT OF STOCK REMOVED	TOLERANCE	PRODUCTION PER HOUR	PIECES PER DRESSING OF WHEEL	GRINDING WHEEL DATA			TYPE OF MACHINE USED
					DIMENSIONS	NORTON WHEEL GRADE	SURFACE FT. PER MIN.	
Grind A	0.60	TRUE TAPER 0.02	203	400	12"x 2"x 5"	60-L Alun.	6,000	No.10 B.&S. Plain

Dimensions in mm Except Wheel Size

FIG. 5—BRONZE TAPERED ROLLER



OPERATIONS LISTED IN ORDER WORKED	AMOUNT OF STOCK REMOVED	TOLERANCE	PRODUCTION PER HOUR	PIECES PER DRESSING OF WHEEL	GRINDING WHEEL DATA			TYPE OF MACHINE USED
					DIMENSIONS	NORTON WHEEL GRADE	SURFACE FT. PER MIN.	
Grind A	0.30	0.01	90	35	12"x 1"x 5"	46-M Cryst.	6,000	No.10 B.&S. Plain

Dimensions in mm. Except Wheel Size

FIG. 6—CAST IRON-BUSHING

Running-In Bearings—Discussion

By Frank C. Hudson

I was much interested in the methods illustrated in the article by Herbert Crawford under the above title on page 382, Vol. 58, of the *American Machinist*, showing the Chalmers method of running in connecting rods and crankshafts. The crankshaft job seems to be all right, as the bearings are run-in with the shaft which belongs with them. In the case of the connecting rods, however, I believe that this method is open to criticism, as it assumes all the crankpins to be of exactly the same diameter, which is never the case, although the permissible tolerances may be very small. Neither do I believe it is advisable to run any new motor over 25 miles per hour for the first five hundred miles.

Running connecting-rod bearings in on a single-size shaft cannot give the proper clearance for lubrication on the different pins. Some are sure to have less clearance than others, and to be more in danger of overheating. When it comes to motor bearings, motor pistons and piston rings, I believe that selective assembly is necessary if we are to have the best work at a commercial price.

Experimental Blast Furnace for University of Minnesota

Preliminary sketches of the proposed experimental blast furnace for the University of Minnesota have been drafted at the North Central Station of the Bureau of Mines at Minneapolis. Records obtained in 34 experimental runs on small scale blast furnaces, conducted by the Bureau of Mines at Minneapolis since 1919, have been studied for the purpose of assisting in the design of this experimental furnace.

These data will also be used in consideration of changes in the bosh and hearth of the furnace stack, now erected outside the Minnesota School of Mines building, which is to be put into blast according to program about the first of May. A method of studying the lines of flow of stock in the blast furnace by the use of cardboard models filled with lead shot, which was developed two years ago, has been used for testing the flow of stock in the experimental blast furnace proposed for the University.

1921 Census of Iron Blast Furnaces

According to the *Washington Service Bulletin* there were 134 establishments reporting blast furnace products valued at $5,000 or more in 1921. The value of the product showed a decrease of 47.6 per cent from 1919 to 1921 and an increase of 31.1 per cent for the 7-year period since 1914. When comparison is made with 1919, the decrease appears big, but it must be remembered that 1919 was an abnormal year.

American Machinist
Established 1877
KENNETH H. CONDIT AND FRED H. COLVIN
Editors

March 22, 1923

The Gun and the Armor Plate in Another Guise

SOME one asked us the other day if it would be of any use to make a twist drill which could stand double the speed of the present high-speed drills. When we lifted our eyebrows just enough to indicate that we were in doubt what it was all about our friend continued: Could anybody use such a drill to advantage? Would he pay more for it than for other drills? Would he have a machine with sufficient speed to use the drill up to the limit?

Here was once more the race between the gun and armor plate. Only in this case the machine has the better of the argument. Discovery of new materials, exhaustive research or invention must precede the production of a tool of greater resisting qualities. As soon as the new tool has been made the machine designer has a definite problem before him and can proceed to solve it. No discovery or invention here; just plain engineering.

And yet, has the machine builder always done his share? Has he always produced the machine which will use the tool up to its limit? Do grinding machines have the proper speeds for various kinds and sizes of wheels and work? Does the small internal grinding machine give the wheel sufficient speed to prevent excessive wear? Do the upright and radial drilling machines have sufficient speed for medium or small drills? Does the screw machine have sufficient speed for work of smaller diameter than its nominal capacity or for small holes? Can the lathe use to advantage a high-speed steel tool when the cut is light and the work of small diameter? Do the shaper and planer have the proper speeds for light cuts?

Strange to say, the development of machine tools after the invention of high-speed steel was along the lines of increased strength and power—the taking of heavy cuts, though by far the greater part of all machine work requires relatively light cuts only.

As one machine-tool builder said some years ago, "We can build a machine which will take a chip a foot square, if *you* will furnish the tool." But he did not say, "We can build a machine which will take a chip at the rate of a mile a minute if you will furnish the tool."

It is true the present tools are not yet capable of taking cuts at that rate, but it is also true that most machines limit the speed these tools are capable of maintaining. And, what is worse, why should anyone try to develop tools which will stand higher speeds if there are no machines in which to use them?

Combinations In Protection of Trade

PRESENT conditions in the crude rubber industry and in certain chemical and drug lines lead us to hope that even the demagogs will admit that there may be combinations to protect trade as well as the combinations in restraint which have given them such good targets. A combination that will advance trade and protect the interests of its members and their country country is not looked at askance by our friends in Europe. On the contrary they rather favor it.

Drastic restrictions to prevent our own industries from devouring each other may be all very well but when such laws put our importers and the rest of us completely in the hands of an alien combination it is time to reconsider. Just such a situation exists with crude rubber. The British colonial growers who control about seventy-five per cent of the world's output can practically dictate the price of crude rubber because it is illegal for our importers to do otherwise than bid against each other for whatever rubber is available. If the supply is insufficient the price is bid up to needlessly high levels. The same situation exists with such commodities as quinine and iodine which are not produced in the United States.

Perhaps if their own pocketbooks begin to suffer from the high cost of imported essentials our windy wiseacres will stop talking long enough to think. One good thoroughgoing thinking spell on the situation would probably lead to a change of policy that would be a boon to American commerce and industry. But probably it is expecting too much of a demagog to ask him to think. The effort might be fatal.

Apparently there is only one thing for us to do and that is to send men to Congress who are able and willing to think and not averse to carrying out the decisions reached by thought. In the meantime tires will probably come high, for Fords as well as for bigger cars.

Beware of Generalities

IT IS A question whether proverbs, rules of conduct and other generalities have done more good than harm. They have a tendency to rock common sense and analytical thought to sleep. If a case is of so little importance that we cannot afford to give it a few minutes of thought, it is hardly important enough to apply a rule to it. You ask a superintendent why he does not do a certain job on the milling machine instead of the shaper, and he answers glibly, "Cutters cost too much." "Why don't you do that job on the screw machine instead of the lathe?" Answer: "Quantity is too small." Did he actually figure out if this is so? Probably not. Most likely he applied two generalities, which everybody is supposed to understand. "But why," you ask, "don't you look carefully into the merits of each case?" "Have too many other things to do." Third generality. Beware of generalities, they cost too much.

Shop Equipment News

Eleveyor Electrical Industrial Elevating Truck

The Eleveyor Industrial Truck Co., 56 Huntington St., Brooklyn, N. Y., has recently placed on the market a material handling vehicle known as the Eleveyor. It may be used either as an ordinary platform truck, or by using its special features, as an elevating and tiering machine.

The main side members of the frame are made of rolled steel, deep in section and rigidly joined to the platform guiding uprights. The uprights are designed to resist flange distortion against the pressure of the platform rollers, and because of their inherent strength they eliminate the need of diagonal bracing and render the battery compartment free of overhead obstructions.

The forward end of the frame is supported on two large helical springs that bear upon the drive axle. The dash and step are each formed of one piece of pressed steel, and the step may be folded up to reduce the overall truck length when necessary.

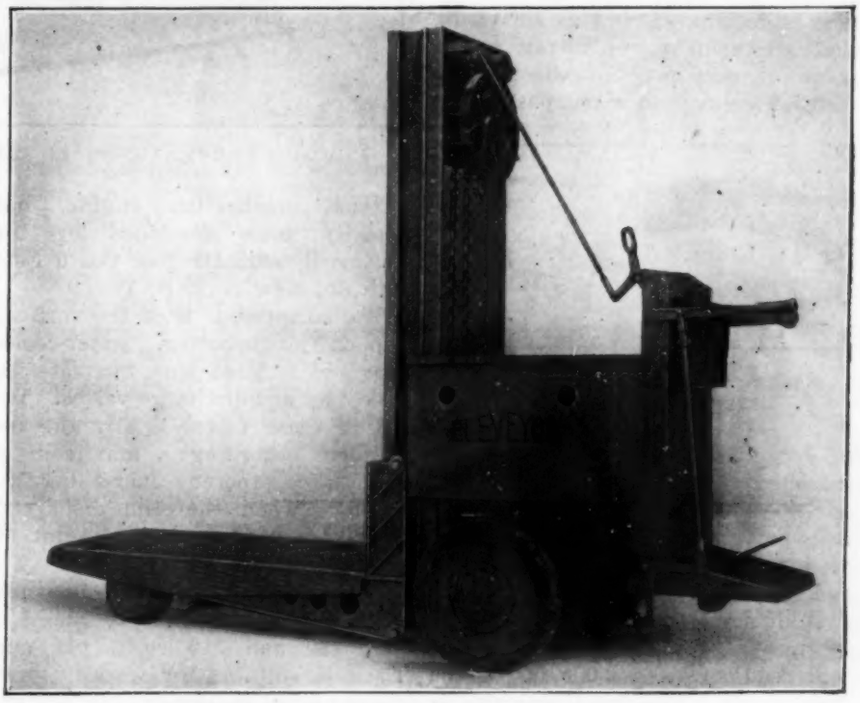
The platform is also one piece of pressed steel, flanged at the sides and supported by two helical springs that project from pockets in the ends of the deeply sectioned supporting arms. The arms extend from the carriage, which has widely spaced rollers that travel in the vertical guides. The platform spring suspension is intended to cushion the load against the shocks of an uneven roadway. The truck is designed to carry 2 tons, and the platform can be elevated through a distance of 70 inches.

The drive gearing is housed between the two halves of the drive axle. A fully enclosed heavy-duty 2-hp. General Electric motor is adjustably attached to the axle housing and drives an intermediate pinion shaft by means of an oversized Morse silent chain. The pinion shaft engages a forged ring gear in the differential on the driving axle. The parts in the axle housing run in a bath of oil. The drive axles are of chrome-nickel steel, full floating, six splined, and engage the road wheels through heavy-duty universal joints, the halves of which are integral with the hub cap. S.K.F. deep-groove ball bearings are used throughout.

The driving, braking and torque stresses are conveyed to the frame by means of a parallel link suspension composed of three links that connect the drive axle with the frame. The torque link is located centrally on top of the axle housing and above the other two horizontal driving links. The parallel arrangement is intended to provide sufficient vertical movement so that either wheel may go over an obstacle without injury to the frame. It is also intended to permit the easy removal of the entire transmission assembly. All four wheels are steered by means of long lever arms, while only two are provided with driving power. The brake drum is placed on the pinion shaft.

A hoist, driven by a separate motor, elevates the platform by means of a chain passing over the load wheel and platform sheave. The hoist gearing consists of a parallel crank motion directed against a spur gear load wheel by two encircling yokes that continuously engage two-thirds of the load wheel teeth. The platform motion may be arrested at any point and is automatically stopped when fully up or down. A double rope control operates the hoist. A total speed reduction of 101 to 1 is had from the motor to the platform.

A 24-volt Exide storage battery is usually employed. The controller is a G. E. unit having three speeds each way. It is equipped with a neutral-return spring to keep the driver's hand on the lever. The truck can be driven 5 or 6 miles per hour when fully loaded.



ELEVEYOR ELECTRIC INDUSTRIAL TRUCK

There are two models of trucks available. Model A has an overall length of either 126 or 117 in., depending on whether the step is down or folded up. It can be turned within a 10-ft. radius. The platform on the model is 70 x 38 in. and is 18 in. above the floor at its minimum height. Model B has an overall

length of 116 or 107 in., respectively, with and without the step in use. When carrying a 36 x 60 in. transportable platform it can be turned within a 96-in. radius. Its elevating platform is 60 x 28 in., and at its minimum height is 11 in. above the floor level. Both models have an overall height of 86½ in. and are provided with 20 x 5 in. drive wheels. The trailing wheels of the models are 16 x 4 and 10½ x 5 in., respectively.

Schaap "Out Slide Mikes" for Measuring Diameters

An instrument for measuring outside diameters on work such as pistons, that reads directly in fractions of an inch and thousandths of an inch oversize has recently been placed on the market by the Schaap Co., 344 Cumberland St., Brooklyn, N. Y.

The "out slide mike," as the device is designated, and as shown in the accompanying illustration, is made of one piece of sheet steel, which thereby limits the possibility

SCHAAP "OUT SLIDE MIKES" FOR MEASURING DIAMETERS

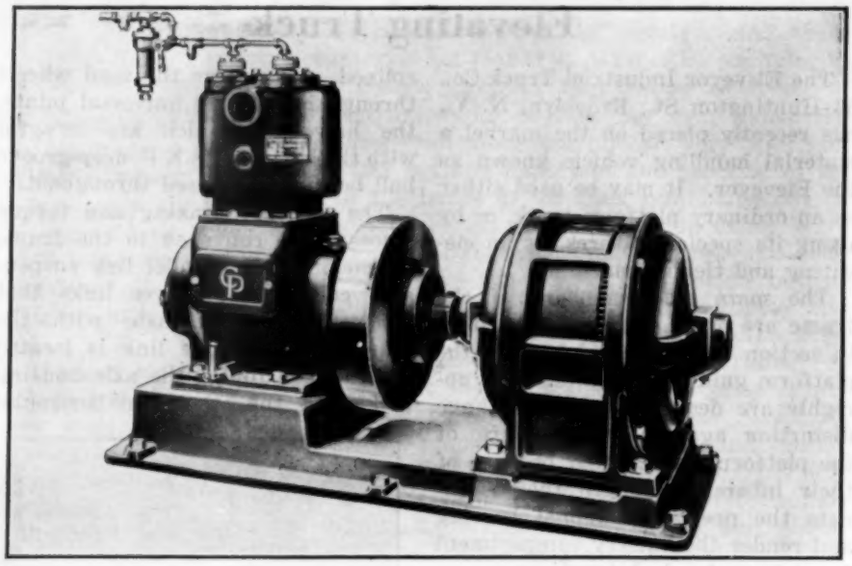
of its getting out of adjustment. It measures diameters from 2⅜ to 5⅛ in. to thousandths of an inch. It does not require the workman to be well versed in decimals to get a reading.

A diameter measuring 4.3175 in. by means of a micrometer caliper, will read as 4⅜ + 0.005 in. on the instrument. The fractional size is read at the point where the arrow matches the scale, and the thousandths of an inch over the fractional size are obtained by matching the graduations on the two ends of the device, as when reading any instrument having a vernier.

The device has graduations that are legible and much larger than those on a caliper. Furthermore, it is compact and does not require the delicate feel that is essential in the accurate use of the micrometer. A similar but smaller instrument measuring diameters from ⅜ to 2⅜ in. is also ready for the market.

Chicago Pneumatic Small Direct-Connected Air Compressor

A small air compressor, shown in the accompanying illustration, that can be run at high speed and directly connected to an electric motor or internal combustion engine, has recently been developed by the Chicago Pneumatic Tool Co., 6 East 44th St., New York, N. Y.



CHICAGO PNEUMATIC SMALL DIRECT-CONNECTED AIR COMPRESSOR

The compressor is of the vertical, duplex, single-acting, water-cooled type and is fitted with Simplate flat disk inlet and discharge valves. The lift of these valves is straight and uniform, affording a maximum of valve area, thereby increasing the speed at which the compressor may operate and allowing the use of direct drive.

The machine is built in three sizes, having piston displacements of 128, 160 and 210 cu.ft. per min. Each is suitable for working pressures of 150 lb. per square inch and is designed to run at a speed of 600 r.p.m. Standard equipment includes a hand starter for the motor and an inlet valve unloader for the compressor.

If an intermittent supply of air is demanded, the motor can be furnished with an automatic starter which starts and stops the unit within predetermined pressure limits. With this type of starter, the compressor is equipped with a centrifugal unloader which automatically relieves the compressor of its load while the motor is starting up or shutting down. This condition the maker claims is essential to the successful operation of an automatically controlled compressor.

A water control valve is also furnished, which is operated by air pressure governed by the centrifugal unloader. Since the lubrication is accomplished by a combination pump and splash system, the complete unit is automatic in every detail, as it controls the electric current, air delivered, circulating water and lubrication.

Clough Machine for Lapping Automotive Cylinders

A machine for lapping the cylinders of automotive engines has recently been devised by R. M. Clough of Meriden, Conn., and is now on the market in conjunction with the hand

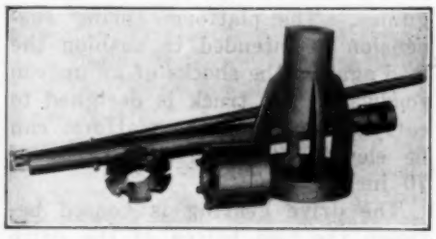


FIG. 1—CLOUGH CYLINDER REAMING FIXTURE, DISASSEMBLED

reaming fixture also made by Mr. Clough.

The reaming fixture is shown disassembled in Fig. 1. It is designed to facilitate reaming the bore of any automotive engine having a removable head, without dismounting the engine from the car or other location. It consists of a guide to be attached

to the cylinder block by means of the regular studs, a bar closely fitting the guide, and one of the standard Clough expansion reamers of suitable size. The reamer is to be turned by hand, while the fixture assures accuracy of centering and alignment.

The lapping machine, shown in Fig. 2, attaches to the cylinder block by means of straps and is driven by a ¼-hp. constant-speed electric motor. The vertical spindle is centered with the cylinder bore and to the lower end is attached, by means of a floating connection, an expanding lap of copper.

The motor drives the spindle at a constant rotative speed of 112 r.p.m. and imparts to it a reciprocative movement at the rate of 49 strokes per minute. The amplitude of the reciprocating movement is quickly adjustable from zero to a maximum of 12 inches. A slip gear in the driving train provides for stopping the reciprocating movement of the spindle at any time without interfering with its rotation. With the slip gear out of action the lap may be moved up or down by hand at will while revolving.

The upper part of the device swivels upon the base so that by

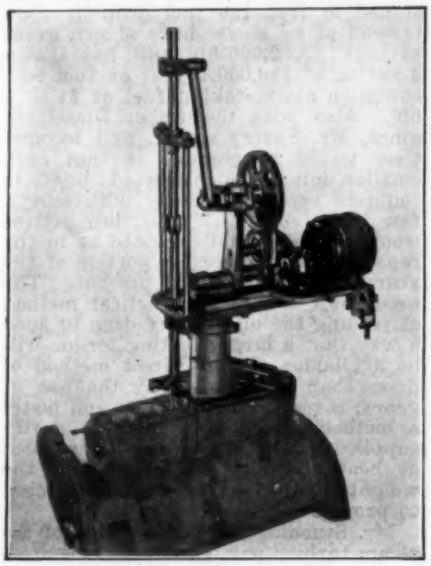
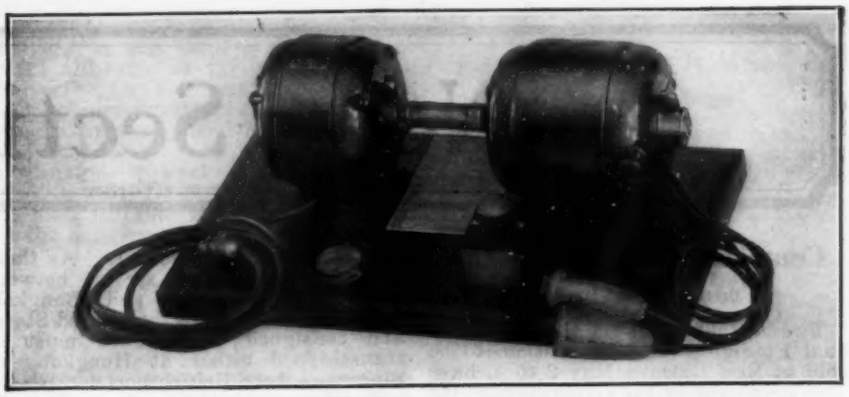


FIG. 2—CLOUGH CYLINDER LAPPING MACHINE

loosening a single clamping bolt, it may be swung out of the way for the purpose of adjusting or changing the lap, and then returned to its central position with certainty by swinging it back against a stop.

After the lapping has been completed upon a bore and before disturbing the setting, a piston and rings may be substituted for the lap for the purpose of running in.



OHIO BATTERY-CHARGING MOTOR-GENERATOR SET

Ohio Low-Voltage Battery-Charging Motor-Generator Set

A low-voltage motor-generator set intended particularly for charging storage batteries such as used on automobiles and radio sets has recently been placed on the market by the Ohio Electric and Controller Co., 5900 Maurice Ave., Cleveland, Ohio.

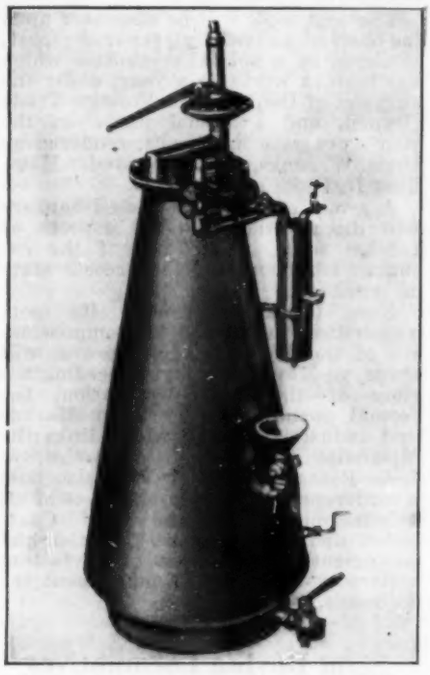
The set, shown in the illustration herewith, is designed for charging 6- to 12-volt storage batteries and consists of a ball-bearing Ohio low-voltage d.c. generator and an Ohio motor wound for a.c. current. The motor and generator are connected by a flexible coupling. An ammeter and rheostat are provided with which to regulate the charging rate, which varies from 1 to 20 amperes. Line connection to the motor is obtained by means of a 10 ft. wire lead with attachment plug, while the batteries are connected to the generator by 6 ft. leads with spring terminal clips. The set is simply and easily operated and runs with comparative silence.

Milburn Portable Acetylene Welding Generator

The latest addition to the line of welding and cutting equipment of the Alexander Milburn Co., 1416 West Baltimore St., Baltimore, Md., is the portable acetylene generator shown in the illustration herewith. The purpose of the generator is to provide a source of acetylene gas for use in oxy-acetylene welding, without the use of cylinders containing gas at high pressure.

The generator has a capacity for 30 lb. of carbide, which is equivalent to 150 cu.ft. of cylinder gas. It has a steel body welded throughout, weighs approximately 200 lb. and stands 5 ft. 3 in. over-all. The diameters of the bottom and top are, respectively, 24 and 12 inches.

The company claims that the generator is simple to operate, having few parts, and that no clocks nor motors are needed because it operates automatically.



MILBURN PORTABLE ACETYLENE GENERATOR

Record Year in Railroad Equipment Buying

That records will be established in the making and marketing of railway equipment during the coming year, is the opinion of Donald D. Conn, manager of the public relations department of the American Railway Association. The buying of freight cars and engines will be continued during the entire year, according to Mr. Conn. During 1922 there were ordered 136,718 freight cars and 2,709 locomotives, which numbers will be exceeded this year. Orders for freight cars of all descriptions Feb. 15 amounted to 97,932 and locomotives ordered numbered 1,915, stated Mr. Conn.

News Section

Central Topics for Foreign Trade Convention

Two central topics for the Tenth Annual Foreign Trade Convention, to be held in New Orleans May 2 to 4, have been developed by the elaboration of the program for the three-day session. They are: "Europe's ability to buy American goods, as evidenced by a thorough-going study of European conditions today and the progress made during the last year," and "The best ways and means to cheapen and perfect the movement of exports and imports between the Central United States and the seaboard."

The first topic will be discussed upon the basis of a carefully prepared report, rendered by a special committee which has been at work for a year, under the auspices of the National Foreign Trade Council, and a special paper on the year's progress in Europe, rendered by Dr. J. W. Jenks, of the Alexander Hamilton Institute of New York.

A group of nationally noted bankers will discuss the financial aspects of foreign trade, the effects of the exchange situation, and the present state of credits.

New Orleans, through its port authorities, the Board of Commissioners of the Port of New Orleans, will stage, on May 5, the day succeeding the close of the trade convention, the formal opening of the Inner Harbor and Industrial Canal, which links the Mississippi with the Gulf of Mexico, via Lake Pontchartrain. It will also hold a conference with representatives of all Mississippi Valley and Gulf Coast cities, upon "better port facilities and equipment" with a view of perfecting waterway transport to supplement the railroads.

Siam Buying Locomotives

A French company has obtained the contract for ten new locomotives for the Siamese State Railways on the basis of the lowest tender in competition with American, British, Belgian, and German concerns, according to a report from Consul E. E. Brodie, Bangkok, to the Department of Commerce. The total amount budgeted being considerably in excess of the lowest tender, a portion of the surplus over and above the price quoted for the 10 locomotives was diverted to the purchase of four additional locomotives from an American company and two from a British concern.

At the present time only British and German locomotives are in use on the Siamese State Railways, and the new contracts mark the introduction into Siam of the first American railway equipment of this character. American exporters are at some disadvantage in obtaining orders for heavy railway equipment in Siam in competition with British and Continental European firms. The greater distance involved necessitates a heavier freight charge on American made products. As there is no direct steamer service between United States ports and Bangkok, freight originating in the United States and consigned to Bangkok must be transshipped either at Hongkong or Singapore, both British ports.

Furthermore, the unfavorable exchange rate is another feature that may in effect be termed discriminatory against American products. The difference between the buying and selling rates in the conversion of American money into ticals or *vice versa* is about 3 cents, whereas the difference in buying and selling sterling is only ¼ cent.

Records Broken at Youngstown Steel Mills

There is at present the greatest boom in the output of iron and steel products that the Youngstown District has ever experienced, not even excepting the period during the recent war. When the schedules for the current week were announced, it was easily observed that the peak to be reached was such as to make a record for the district. Taking as a whole all iron, steel and fabricating industries, they are said to be operating at approximately 95 per cent of their capacities at present.

While steel making continues at full capacity, more blast furnaces are being blown in. It is stated that of the 117 sheet mills in the district, 115 of them are in operation. Thirty-seven of the forty-six blast furnaces in the district are producing, with preparations underway for opening more of them.

Meeting of American Engineering Council

A meeting has been called for March 23 and 24 of the executive board of the American Engineering Council, the executive body of the Federated American Engineering Societies. The meeting will be held at Cincinnati, Ohio, and government reorganization and reforestation will be taken up.

Officers of Hungarian Engineers

The following officers were elected for the coming year by the Social Organization of Hungarian Engineers: Alexander Strobl, president; Dr. Adalbert Elek, vice president and Julian J. Wittal, treasurer.

Pan American Conference

The fifth annual Pan American Conference will be held Mar 25 at Santiago, Chile, under the auspices of the Chile-American Association. An interesting program has been outlined and many prominent speakers have accepted invitations to be present.

A.S.M.E. Discussion on Turbine and Diesel Locomotives

The regular monthly meeting of the New York section of the A.S.M. E. was held on March 13. Papers were presented on the application of the Diesel engine and steam turbine to the locomotive, by Elmer A. Sperry, president of the Sperry Gyroscope Co., and Albert F. Stuebing, mechanical department editor of the *Railway Age*. Mr. Sperry also presented at the meeting a return message from the national engineering body in Japan, to whom on the occasion of its twenty-fifth birthday, he had, as an honorary vice-president, last autumn presented greetings and congratulations from the A.S.M.E.

The discussion on the Diesel engine by Mr. Sperry emphasized the fact that in the comparatively near future this type of internal-combustion engine is bound to replace the steam locomotive. No practical working model has yet been devised, however, so that the useful steam locomotive with its wasteful consumption of fuel must still be the chief source of transportation. The experimental models that have been designed to feed the fuel drop by drop instead of *en masse* have shown great savings. A 2,000-hp. unit has shown a saving of $90,000 a year on fuel consumption alone, taking fuel at $1.50 a bbl. Also, with the use of Diesel engines, Mr. Sperry stated, unit locomotives would be possible so that each smaller unit of which it would be made could be replaced quickly with only a few hours' delay. Thus, locomotives would be on the rails instead of in the repair shops the greater portion of the year as is the case at present. The needs now are for a practical method of feeding the oil drop by drop in such a way that a large starting torque will be available; a more direct method of drive than is supplied by the use of gears; a smaller boiler unit; and lastly a method, which is at present partly supplied by the use of auxiliaries such as heat and light units, whereby the weight of the locomotive is increased to provide traction power.

Mr. Stuebing in his discussion of the steam turbine pointed out that the present experiments are failures largely because of the limited horsepower that can be developed by the turbine that must be used. He stated that in its present stage it is impractical for American use, as any saving of fuel resulting would be counteracted by a greater increase in the labor costs due to an increase in the number of locomotives needed to pull the same weight of cars. An increase of train units would also increase the number of double tracks and sidings required and would further demand larger terminals. All this would cost so much that it is problematical if the turbine can ever be of practical use on locomotives, even at a great saving of fuel.

Research Graduate Assistantships Available at University of Illinois

To assist in the conduct of engineering research and to extend and strengthen the field of its graduate work in engineering, the University of Illinois, Urbana, maintains fourteen Research Graduate Assistantships in the Engineering Experiment Station. Two other such assistantships have been established under the patronage of the Illinois Gas Association. These assistantships, for each of which there is an annual stipend of $600 and freedom from all fees except the matriculation and diploma fees, are open to graduates of approved American and foreign universities and technical schools who are prepared to undertake graduate study in engineering, physics, or applied chemistry.

An appointment to the position of Research Graduate Assistant is made and must be accepted for two consecutive collegiate years of ten months each, at the expiration of which period, if all requirements have been met, the degree of Master of Science will be conferred. Half of the time of a Research Graduate Assistant (approximately 900 clock hours for each ten-month period) is required in connection with the work of the department to which he is assigned, the remainder being available for graduate study.

Nominations to these positions, accompanied by assignments to special departments of the Engineering Experiment Station, are made from applications received by the Director of the Station each year not later than the first day of March. The nominations are made by the Executive Staff of the Station, subject to the approval of the President of the University. Nominations are based upon the character, scholastic attainments, and promise of success in the principal line of study or research to which the candidate proposes to devote himself. Preference is given those applicants who have had some practical engineering experience following the completion of their undergraduate work. Appointments are made in the spring, and they become effective the first day of the following September. Vacancies may be filled by similar nominations and appointments at other times. This year the latest date for filing applications has been extended to April 1.

Foundry Iron Market Increasingly Active

The great demand for pig iron is evidenced by the heavy buying and the price advances. The amount of sales seems to be gradually increasing. The movement has gone so far that many furnaces have already sold out their entire production up until July, and more of them are very near to this stage.

It seems that the iron is being bought by a variety of industries, the radiator line being particularly active. Foundry iron was the most in demand, with malleable iron following. A large amount of high-silicon iron has also been ordered. The greater portion of the business was in northern iron, although there is great activity in the sale of southern iron.

Many buyers have placed orders for delivery in the third quarter of the year, although so far practically no deliveries for the last quarter have been scheduled. Buyers evidently foresee a comparative shortage of material for some months to come and they are anxious to stock. There is also a great activity in the ferro-manganese and coke markets, influenced, of course, by the activity of the foundries.

January Machine Exports Same as Year Ago

After the particularly good showing in December, exports of metal working machinery in January of this year slumped to practically the level of exports in January of 1922. The detailed figures, which are those of the Bureau of Foreign and Domestic Commerce, follow:

EXPORTS METAL-WORKING MACHINERY

	January 1922	January 1923
Lathes	$64,316	$58,683
Boring and drilling machines	84,435	57,922
Planers, shapers and slotters	20,508	15,965
Bending and power presses	74,698	23,205
Gear cutters	8,104	5,550
Milling machines	14,599	65,597
Thread cutting and screw machines	11,373	28,963
Punching and shearing machines	6,804	34,902
Power hammers	14,568	7,960
Rolling machines	172	.....
Sharpening and grinding machines	43,296	70,233
Chucks; centering, lathe, drill and other	22,443	19,900
Reamers, cutters, drills and other parts for machine tools	77,428	123,418
Pneumatic portable tools	22,390	26,817
Foundry and molding machinery	4,522	9,799
Other metal-working machinery and parts of	456,081	392,259
Total metal-working machinery	$925,737	$941,173

Chicago Machinery Club Has Many Members

Following a vigorous membership campaign, the Chicago Machinery Club announces that its total membership at the present time is 1,036. The "drive" was directed by Edward P. Welles and he was ably assisted by many workers apportioned into two groups that were directed by Frank Adkins and Roy Porter with nine captains to a group. The new membership makes the Chicago Club one of the biggest in the country and many expressions of gratification upon the condition of the machinery industry and the Club were expressed at the dinner held March 15 when the new members were introduced to the old ones.

Philadelphia Foundrymen Discuss Pneumatic Tools

On Wednesday evening, March 14, the members of the Philadelphia Foundrymen's Association, Inc., held a dinner at the Manufacturers' Club and followed it by its monthly meeting, which was devoted to the subject of pneumatic tools. A. M. Brown, district sales manager in Philadelphia for the Chicago Pneumatic Tool Co., presented a moving picture of air tools for the foundry, machine shop and other lines. The pictures were taken under the direction of the United States government in order to show the improvement made during and since the War of all makes of pneumatic tools.

Merger of Bethlehem and Midvale Companies Ratified by Stockholders

Several steps have been taken recently in the merger of the large independent steel companies. Stockholders of the Bethlehem Steel Corporation and of the Midvale Steel & Ordnance Co., on March 12 ratified the merger of the two companies. Under the terms of the consolidation, which follows the acquisition of the Lackawanna Steel Co. by the Bethlehem Steel Corporation, Midvale turns over all its properties except the Nicetown plant. This plant will be controlled by a new corporation to be formed with 200,000 shares of no-par-value stock, which will be distributed pro-rata among the Midvale shareholders.

Stockholders of the Bethlehem Steel Corporation authorized an increase in the company's common stock of $119,500,000 to finance the Midvale purchase. The purchase of the Cambria Steel Company, subsidiary of Midvale, was also approved by Bethlehem stockholders.

Midvale stockholders, in approving the sale of the company's plants to Bethlehem, voted to reduce the capital from $150,000,000 to $5,000,000 for the purpose of maintaining its corporate existence. Consent of the bondholders is to be obtained at another meeting to be held on March 20.

Minority stockholders of the Cambria Steel Co. are stated to be forming a protective committee to contest and oppose the sale of the company's property to the Bethlehem Steel Corporation. Their objections to the deal are said to be based on the claim that the present basis for the sale of the Cambria property to Bethlehem is below its real value.

A number of the minority stockholders attended the special meeting of the Cambria Steel Co. held in Philadelphia on the 12th, and engaged counsel, who also attended the meeting. The special meeting of the Cambria was adjourned until March 20 to await the necessary deposit of bonds of the Midvale Steel & Ordnance Co. to permit Cambria stock owned by the Midvale to be voted in favor of the sale.

Shortage of Freight Cars Increases

Requisitions for freight cars in excess of the current supply amounted to 80,633 cars on Feb. 28, or an increase since Feb. 23 of 3,733 cars, according to reports filed today by the carriers with the Car Service Division of the American Railway Association.

The shortage in box cars numbered 33,857, an increase since Feb. 23 of 3,770, while the shortage in coal cars totaled 38,771, or a decrease of 426 within the same period. The shortage in refrigerator cars also totaled 2,617 or an increase of 522 cars in the five day period, but a decrease within that time of 292 was reported for stock cars which brought the total to 948.

Surplus freight cars in good repair amounted to 15,819. This was a decrease from Feb. 23 to Feb. 28 of 4,967 cars.

Surplus box cars in good repair totaled 2,739, which was a reduction of 2,336 since Feb. 23.

News of Washington Activities

By Paul Wooton

WHILE differences of opinion among members of the Tariff Commission have existed, and continue, there is no friction so serious that the work of the Commission is hampered or which makes the resignation of any member of that body imminent, according to a canvass of the members. Recent newspaper dispatches had indicated changes in personnel owing to dissentions in the Commission.

There is a sharp division of opinion between two groups of commissioners regarding the authority given them by the new tariff act and the executive order delegating to the Commission certain powers conferred upon the President by that act and there have been differences regarding methods of procedure.

While the commissioners have differed they have not quarreled. A picture of the commissioners quibbling around the council board with any member threatening to resign unless his views were accepted by the others is overdrawn and highly colored. It is entirely possible, of course, that future developments may result in one or more members resigning because he or they cannot accommodate deep seated convictions to the settled policy of the Commission, but at present each member has denied a plan to resign.

As a matter of fact, the Tariff Commission appears to have reached a stage of understanding which will produce within the near future full functioning under the additional powers granted the Commission by the 1922 act, particularly the flexible tariff sections by which the Commission, after investigation, may recommend to the President changes in duties to equalize costs of production here and abroad. Henry H. Glassie, recently appointed a member of the Commission, took his seat March 8, thus giving the Commission a full membership of six for the first time since last summer when Thomas W. Page resigned.

The main point of difference between the commissioners has been whether the Commission should undertake on its own initiative to make surveys looking to discovery of inequalities in the 1922 tariff act, or whether it should confine its activities regarding recommendations for changes in duties to investigation of those specific commodities regarding which applications under the flexible tariff sections were filed with it. The latter view, that of restricted authority, has been championed by Chairman T. O. Marvin and the former view by Vice-Chairman W. S. Culbertson.

It is said that several leaders of Congress have intimated to the Commission that it was not the intent of Congress that the Commission should rewrite the tariff act, but that the flexible tariff section was included so that relief might be afforded in cases where conditions had so changed after enactment of the new tariff that the duty prescribed on a specific commodity might be either too high or too low.

The President has been asked to give his interpretation of the act for the guidance of the Commission, it is understood, and probably will refer the question to the attorney general after his return from Florida.

Meanwhile, the Tariff Commission is preparing to proceed with field investigations of applications for changes in duties which have been filed with it, and apparently is proceeding with harmony and good feeling existing among its members.

Wider adoption and increased use of standards in automobile and motor truck construction, particularly as applies to uniform sizes for certain parts, were discussed March 9 at a meeting of representatives of various interested associations called by the Division of Simplified Practice of the Department of Commerce.

It was suggested, for instance, that instead of the 15 sizes of spark plugs now on the market, it might be possible to adopt three sizes which would answer all purposes of service. Another suggestion advanced at the meeting was that the outside dimensions of battery containers be standardized so that any battery would fit any car without change in equipment.

As a result of the conference, a central committee was decided upon to represent engineers, manufacturers, distributors, dealers, garage operators and service men, owners and users, and the trade press to co-operate with the Joint Committee on Simplified Practice of the Society of Automotive Engineers and the National Automobile Chamber of Commerce to bring about reduction of excessive sizes. The first subjects to be taken up by this central committee will be spark plugs, roller bearings, storage batteries and tires.

M. L. Hemingway, general manager of the Motor and Accessory Manufacturers Association, was elected permanent chairman of the central committee, and Carey E. Quinn, of the Automobile Body Builders Association, was elected permanent secretary. Each association interested will name one member of this central committee.

One of the principal speakers at the conference was C. C. Hanch, vice-president of the Lexington Motor Car Co., who declared that there is much room for simplification and standardization in the automobile field despite the great strides in this direction by the industry in the last few years.

Among organizations represented were the National Automobile Chamber of Commerce, the Motor and Accessory Manufacturers Association, Automobile Body Builders Association, Automotive Metal Wheel Association, American Gear Manufacturers Association, Automotive Electric, Motor Truck, Tire and Rim and other associations. Delegates were present representing dealers, equipment, National Hardware and other organizations, while large users of motor trucks also were represented.

With the removal of uncertainty with regard to its appropriation and in fact its very existence, the President's Coal Commission is bustling with increased activity. The statistical force has been expanded and the tabulation of the information contained on the questionnaires has been speeded up decidedly. During the week ended March 10 a material increase in the rate of tabulation was achieved. The returns also are coming in greater numbers.

Federal Fuel Distributor Wadleigh reported on March 11 that there has been some improvement in the fuel situation in New England and northern New York. Largely due to motive power trouble, there still is room for great improvement in the railway service. Difficulties continue in New England harbors and a number of applications for service orders intended to give priority to the discharge of coal cargoes have been filed. Mr. Wadleigh stated that it is the present plan to issue another stock report on April 1 and still another on June 1.

Comparative Prices of Shop Supplies

Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0322	$0.0303	$0.0239
Cold finished shafting	per lb.	0.0406	0.0397	0.0333
Brass rods	per lb.	0.1870	0.1804	0.15
Solder (½ and ½)	per lb.	0.2887	0.2617	0.20
Cotton waste	per lb.	0.1181	0.1181	0.109
Washers, cast iron (¼ in.)	per 100 lb.	4.33	4.33	3.83
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	2.96	2.96	3.11
Lard cutting oil	per gal.	0.5575	0.5575	0.57
Machine oil	per gal.	0.349	0.349	0.40
Belting, leather, medium	off list	49%	49%	46¼%
Machine bolts up to 1 x 30 in.	off list	51¼%	51¼%	64¼%

American Engineering Council to Meet in Cincinnati

Many problems of prime importance to the nation and to the engineering profession will be considered by the Executive Board of the American Engineering Council, governing body of the Federated American Engineering Societies, at its next meeting, which has been fixed for March 23 and 24 in Cincinnati.

The Board's sessions will be held at the Ohio Mechanics Institute, President Mortimer E. Cooley presiding. On March 22, at 8 p.m., the Committee on Procedure will meet at the Hotel Gibson. Arrangements are under way for a meeting of Cincinnati engineers on the evening of March 23 at which addresses will be delivered by members of the Executive Board. The opening session of the Board will be called at 9:30 a.m., to be followed by an afternoon session at 1:30.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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DESPITE THE GLOOM and irritation of income tax week the markets have been steady and resilient. Many commodities are higher and none have registered any serious decline. Textiles and the raw materials of which they are made, wool, silk and cotton, have all advanced. Cotton has been particularly strong on the figures of February consumption, which indicate that our domestic mills are now using up cotton at the rate of 7,200,000 bales a year. The balance left for export is so small that it is not surprising that the cotton manufacturers of Europe are disturbed.

The activity of the steel industry is also remarkable. The demand is, however, very much in excess of the production, which is seriously restricted by the scarcity of labor. The automobile makers are in much the same predicament, but with them it is not so much a question of labor as of getting the steel that they require for an output which promises to break all previous records.

In the building trade similar conditions obtain. The new construction planned is without precedent and badly needed. Building materials of nearly all sorts are in consequence advancing, as are the wages of mechanics. It is asserted that in some cases $30 a day is being paid to bricklayers, carpenters and plasterers, and the result has been the postponement of several important building projects for which the capital has been provided.

The most important question of the immediate future is, in fact, the labor question. Neither the labor unions nor the individual wage earners are to blame for the conditions existing.

It is a plain case of supply and demand. The immigration law makes the importation of additional labor impossible and there are not enough hands in the United States to do the work that is waiting to be done. Employers are, in consequence, commencing to bid against each other for the labor required, and it is to be feared that wages may be driven to an impossible level when the farmers enter the labor market in the spring.

As high wages mean higher prices for what the wage earners produce, the advance in commodities seems likely to continue until through maladjustment it brings about a buyers' strike, or something happens to disturb confidence and make capital cautious about embarking in new enterprises.

It must be admitted that there is nothing of the sort in sight on this side the Atlantic at present. In the United States and Canada the feeling seems to be growing more optimistic from week to week and the area of prosperity appears to be widening, for it now includes Cuba and Mexico as well as the South American countries which have profited by the advance in coffee, sugar, cotton and nitrates.

But in Europe it is another story. The tenseness of the situation created by the French occupation of the Ruhr is increasing day by day. In Russia the outlook is far from satisfactory, for with Lenine stricken by paralysis and Trotsky gravely ill no one knows what will happen. In England confidence in the Bonar Law government is apparently dwindling and Lloyd George's early return to power is definitely suggested by the news received here.

In how far and for how long America can remain unaffected by the unsettlement and chaos abroad remains to be seen, but on the Stock Exchange where the adumbrations of distant clouds are usually first noticeable the feeling is less buoyant than in the commodity markets.

It may be that the reactionary tone of the security market, if it can be so described, is not in any way related to what is happening in Europe, but as we look back at the Stock Exchange record of July, 1914, it is plain that it gave some intimation of trouble ahead, and its barometric readings should never be entirely disregarded by careful students of the future.

The weekly statement of the Federal Reserve Banks shows a loss of $5,000,000 in the gold held and a reserve ratio of 75.4 per cent as compared with 76.2 per cent a week ago. The other changes are neither important nor significant. There is plenty of money to finance the increasing activity of trade.

The scarcity of labor in this country and the political unsettlement in Europe are the only influences in sight that threaten trouble. Both now appear to be rather remote, but just as we are enjoined to beware when all men speak well of us, so it is the part of wisdom to be prepared for rain after a long spell of fair weather. That I may more intelligently gage the probable duration of our present prosperity I am submitting the questions on the accompanying coupon to about 15,000 men of large affairs throughout the country.

Answers from the readers of this letter will be appreciated. They can be filled in the blank spaces provided and the coupon, duly signed, may be cut out and mailed to the address given at the top of this page.

An impersonal digest of the replies received will be published, but the names of those who have answered the questions will not be disclosed.

Please check "YES" or "NO" as you would use either word in answering the questions opposite which they appear

Do you share the general expectation of good times?	Yes / No
If so, until about what date do you expect them to continue?	
..... *(Give Month and Year)*	
Do you think we will have a buyers' strike if prices continue to advance?	Yes / No
How much of an advance expressed in percentage, would bring about such a strike? ..... *(Give percentage in figures)*	
In your section is there any apprehension that a failure to settle the Franco-German imbroglio would react unfavorably upon American prosperity?	Yes / No

Name.....

Business.....

Address.....

City.....

Prices and Wages Increase in Alabama District

The base price of pig iron in the Alabama district is to advance at once, according to good authority, from $25 to $26, some of the smaller furnaces already selling at the latter price. Production is continuing at a high level throughout the entire district and all over the South as compared with what it has been, and no difficulty is being met in selling the entire melt of the furnaces.

The make for second-quarter delivery now is almost exhausted, and the $26 price is for third-quarter delivery, though very little tonnage for for the third quarter as yet has been reported sold.

Recently there have been increases in labor costs at most of the southern industrial plants, principally in the brick, lumber and the iron and steel industries, causing prices to increase to some extent. In the Alabama district thousands of workers in the mills and factories have been granted increases.

Case Threshing Machine Co. Shows Betterment

The net profits for 1922 after all charges were deducted for the J. I. Case Threshing Machine Co., Racine, Wis., were $321,269. In 1921 the company had an operating loss of $583,431. The reduction in surplus for that year was $2,193,431 against a reduction of $305,118 in 1912.

German Industry Becoming Inactive

Mental state now prevalent causes inaction—Shortage of coal and steel because of occupation of Ruhr—Conflicting movements of prices and mark rate disastrous

By OUR BERLIN CORRESPONDENT

THE RUHR OCCUPATION has in its consequences created a situation which in its complexity is not surpassed by any of the various entangled stages traversed since the end of the war. From the erratic actions passing before the eyes and still more so from the peculiar spirit of inaction, which keeps initiative under a spell, it can be seen how this situation dominates.

The following point of view of a man manufacturing in a large way is typical: "What is the use of making dispositions? Decisions arrived at today after deep thinking may turn out to be wrong in a week's time. We cannot afford to make mistakes. Since we cannot see a week ahead, we have to restrict our actions to the narrow limits in which we can survey possibilities with some certitude. This is hardly more than from today until tomorrow."

This apathy, caused in no mean degree by the secret but violent pulls of the ropes which move the mark exchange, is mingled with a great deal of carelessness, inspired partly by optimistic views held out in the newspapers, and in another part by the secret hope that the Ruhr occupation is a short episode only, which might end any day. The mentality in manufacturing circles closely resembles that of war times. Foresight and forethought are lacking. Beyond the immediate needs of the day hardly anything is being done, even in the face of the great emergency close at hand, the greatest which the industry has yet experienced.

Coal Shortage Serious

This mentality is the only explanation which presents itself for the peculiar remissness prevailing in the matter of the industry's pressing needs for substituting the Ruhr supply of basic materials. During January only 540,000 tons of British coal have been imported, which is hardly more than a fourth part of the quantity received in October and November. The import licences for British coal applied for during January, i. e., at a time when the stoppage of the Ruhr supply had become a certainty, did not, as one would have been led to expect, exceed the size of previous months, but remained considerably behind. The numberless private consumers have, after the coal transport from the the Ruhr came to an end, commenced to draw on the reserves, and have in the majority left the rest to Providence.

The orders placed for foreign coal are large, but, as far as can be seen, entirely inadequate to meet the emergency. It is true that foreign markets have been flooded with inquiries, but the percentage of coal, iron and steel orders placed is comparatively low. This state of affairs explains the remarkable move of the German Government to throw its gold funds upon the money market to be picked up by consumers at comparatively low rates, in order to enable them to cover their needs at no sacrifice to themselves. These gold funds originate from industry, which, it will be remembered, has to surrender part of the export proceeds, in the average 25 per cent, to the government in exchange for paper money. Large funds have thus accumulated for the avowed purpose of reparation payments. The government having cancelled the latter and needing gold funds only as far as the supply of the state enterprises, chiefly the railroads, is concerned, it was natural that it should decide that they find their way back to industry. As far as can be seen up to the middle of February, the government's sacrifice in the interest of industry has succeeded only partly.

Influence of Exchange Rate

The receeding of the dollar tide has left German coal prices high and dry, quite towering over British prices. The German coal, for instance, equalling British best steam No. 2 was quoted at the middle of February in Hamburg at 220,000 marks, which at the rate of exchange of that time equals 55/—. The activity, which has been expected to arise from such unheard of discrepancy in favor of German consumers has failed to materialize. Manufacturers were waiting for the mark to improve further. One of the large Berlin machine building works, for instance, consuming from 30,000 or 40,000 tons of coal per month, has decided to place an order for 6,500 tons of British coal. The reserves are running low already, without further supplies being in sight.

In the matter of iron and steel, the industry can hold out some time, estimated at from 6 to 8 weeks. It is, however, quite sure that the present rate of production cannot be maintained for more than three or four weeks longer. The alarming shortage of foundry iron and coke, which is already clearly visible, is alone sufficient soon to put the machine building industry partly out of business.

Effect of Mark Fluctuation

Quite apart of these tremendous difficulties, the situation, as it resulted after the wild upward and downward fluctuation of the mark rate, is fraught with other difficulties, which are having serious consequences for the industry. The onrush of prices, following closely the stupendous rise of the money depreciation, has sharply collided with the latter's sudden reverse movement. The impact has somewhat delayed the movement of the former, but has not brought it to a standstill. Not only the price of German coal has suddenly surpassed the world market level, but also that of most other industrial products. The new prices of iron and steel products, in force since February 15, i. e., after the ratio of the mark to parity had been reduced to 1:5,000 by deliberate manipulation of the government, were adjusted for foundry iron No. 1 at 749,000 marks per ton, and for mild steel bars at 1,183,000 marks per ton.

In the first case the price equals, at the ratio mentioned, 149 gold marks, compared with a price of 77.50 in pre-war times; and in the case of bars, 236.50 compared with 97.99 pre-war price. A similar relation applies to all basic materials of the machine building industry, and in a still stronger degree to products of the higher stages of manufacture. In fact, all products now on the market and in the course of manufacture have suddenly become absolutely unmarketable.

To this serious disturbance of customary relations of prices to pre-war prices must be added the 100 per cent increase in railway freightage, which has come into force on February 15th. By this increase freights have been raised to 5,700 times their pre-war level, and in the case of products shipped for export, even beyond that. The freight for rolled products to Hamburg or Bremen for shipment abroad is now 6,540 times and in the case of iron and steel products including machinery 8,670 times higher than in pre-war times. It is quite sure that the effects of this increase, will soon find expression in an all-round increase of cost.

Stagnation of Business

The few weeks which passed between the enormous drop of the mark and its almost as quick recovery, have in their aftermath taught the country a severe lesson. The drop has in the short time of its duration engraved such deep lines on the face of things, that the recovery following it closely cannot eradicate them. The reverse movement had, while it was still rather far away from the starting point of the drop, commenced to produce convulsions in business life of such grave nature, that it had brought business almost to stagnation. Orders contracted in foreign money had become unprofitable, and domestic orders are withheld on account of the uncertain future. The tendency to retract on orders already booked, which could be noticed prior to the Ruhr occupation, has gained force, bringing all business in hand into a point of tottering.

Under present circumstances business cannot sustain the tension brought about by a strongly conflicting movement of prices on the one hand and the mark rate on the other hand. If even the officially controlled parts of cost, such as the basic products, coal, iron and steel, as well as the freight rates, which latter are completely under the control of the government, cannot be compelled to follow the reverse movement of the money depreciation, it cannot be expected that all others can be screwed down. In the matter of wages this reversal would be a sheer impossibility. It would immediately cause a labor conflict, which the country in its present plight cannot possibly afford.

If actual production does not exhibit yet any marked change for the worse,

this is solely due to the inherent momentum of inertia. The decline of the market has, however, been greatly precipitated. This is shown by the growing rate of unemployment, which is reported from all parts of the country. In the machine building industry, which ranged lowest with regard to unemployment amongst the various categories, the rate has grown at a remarkable speed.

The level that prices have reached, could only be borne in the consideration that, transmuted into gold marks, it was still a little below the pre-war level. In numerous cases, like for instance heavy machinery, even this contention could not be applied any longer. The improvement of the mark rate has thrown this relation out of balance. As a consequence, buying is restricted to imperative necessities. Greatest reserve and a strong tendency to retrenchment can be noticed everywhere.

In the export business manufacturers have been put before a considerable dilemma. Business being contracted in foreign money, an improvement of the mark rate reduces the proceeds, thereby reacting sharply on the profit of the manufacturer. A sudden doubling of the value of the mark, as has been engineered in February, corresponding with the collapse of the proceeds to one half of their value, is therefore causing serious disturbances. At the mark rate of 5,000 to parity, export orders have become ruinous.

Although the duration of this rate is universally doubted, the uncertainty prevailing with regard to the Government's further manipulations on the money exchange, is causing considerable reluctance on the side of the manufacturers. The spirit has diminished the vigor with which manufacturers have pursued the export business. A strong reserve exists also on the other side, that of the buyers, in view of the uncertain deliveries apprehended, as a consequence of the Ruhr occupation. The export business to France and Belgium has come to an almost complete standstill. The only satisfactory point which can be seen in the situation, is the steadily growing export business with Russia.

Obituary

HOWARD M. WILSON, president of the Taylor-Wilson Manufacturing Co., Pittsburgh, Pa., Feb. 16 at the age of 61 years. Mr. Wilson was educated at the Rensselaer Polytechnic Institute, Troy, N. Y.

HERMAN PETERSON, 40, president of the Semi-Steel Foundry Co., Barberton, Ohio, was killed last week by a railroad train near the company's plant. He leaves a widow and five children.

COL. PERCY SOWERS, Canton, Ohio, died recently at Salt Lake City, Utah. Following the Civil War, Col. Sowers returned to Canton where he joined the late Cornelius Aultman in the organization of the Canton Malleable Iron Co. He was one of the pioneers in the manufacture of Buckeye reaping and harvesting machinery, and was interested in the Aultman plant at Canton and factories in Mansfield, Ohio, Battle Creek, Mich., and Auburn, N. Y. Later, Cornelius Aultman and Col. Sowers organized the first Canton Steel Co., afterwards operated by Bolton Meyers and Co. Col. Sowers also organized the Canton Steel Railway Co. and a line to Massillon.

Personals

L. E. CARPENTER, for many years vice-president and general manager of the Athol Manufacturing Co., Athol, Mass., has retired. W. G. NIMS has been elected president and SPENCER A. REED has been made general manager and treasurer.

R. A. HOPKINS has been appointed manager of the newly established Engineering Division of the Westinghouse Electric Co., Los Angeles office.

E. E. BLACKWELL, for the past eight years a member of the engineering department of the Champion Spark Plug Co., Toledo, Ohio, has joined the sales department of the new Detroit plant of the Morse Chain Co.

O. H. LEIDY, for the past year district sales manager, with headquarters at Indianapolis, for Reed-Prentice, Becker Milling Machine Co., Whitcomb-Blaisdell Co. and the Cincinnati Planer Co., has recently joined the organization of the L. S. Starrett Co. He will cover the northern territory, making his headquarters at the Chicago branch office.

J. C. JONES has been appointed manager of the Central Station Division of the Westinghouse Electric Co., Los Angeles office. This division was formerly the Power Division. Mr. Jones is also in charge of the sale of supply apparatus in that territory.

G. B. KIRKER has been appointed manager of the Transportation Division of the Westinghouse Electric Co., Los Angeles office. This division was formerly known as the Railway Division.

J. H. JAMISON has been appointed manager of the newly created Merchandising Division of the Westinghouse Electric Co., Los Angeles office.

JOHN SCANLON has been appointed superintendent of the tinhouse of the Farrel, Pa., plant of the American Sheet and Tinplate Co., Youngstown, Ohio. He succeeds Baker Boyd who left several weeks ago to accept a position in the tinplate plant at New Kensington, Pa.

J. L. SIMMON, formerly general manager of the Union Malleable Iron Co., East Moline, Ill., has been named general manager of the Canton, Ohio, plant of the Dayton Malleable Iron Co., Dayton, Ohio.

FREDERICK L. HARTEN, secretary and assistant treasurer of the Bay View Foundry Co., Sandusky, Ohio, has disposed of his interest in the company to A. J. Wentworth, of Cinncinnati, who is vice-president of the company.

R. W. BAKER has been made New York district manager for the Howell Electric Motors Co., of Howell, Mich. The office has just been opened at 17 East 42nd St., New York City.

E. H. COOPER was re-elected president of the Fafnir Bearing Co., makers of bearings and hangers, of New Britain, Conn., at the annual meeting of the directors.

MAURICE STANLEY was re-elected vice-president and secretary.

ALFRED G. WAY was made treasurer to succeed Mr. Cooper, who was formerly treasurer as well as president.

E. KENT SWIFT, treasurer and general manager of the Whitin Machine Works, Whitinsville, Mass., sailed March 8 from San Francisco on the steamship "President Pierce" on a business journey to the Orient. He will be accompanied by Mrs. Swift, and ROBERT GAITHER and PHILIP REILLY, both of the same firm. They expect to be gone three months.

W. H. WHITE, who was formerly president of B. M. Jones & Co., Inc., importers of mushet steels and Taylor iron, has been appointed manager of the new district sales office of the Atlas Steel Corporation, of Dunkirk, N. Y., in the Hanna Building, Cleveland, Ohio. With the direct representation from the mill and the distributors as now appointed, The Atlas Steel Corporation is in a position to give quick service. The distributors are: The W. Bingham Co., Cleveland, Ohio; Dickerson Steel Co., Dayton, Ohio; and Mitchell Steel Co., Cincinnati, Ohio.

IRVING H. JONES has resigned as sales engineer for Joseph T. Ryerson and Son, Chicago, to become director of railroad development for the Central Steel Co., Massillon, Ohio. Mr. Jones will have his offices in the Peoples Gas Building, Chicago, which is the western headquarters of the company.

DANA E. WILLIAMS, of Akron, Ohio, has been elected president and general manager of the Semi-Steel Foundry Co. at Barberton, Ohio, succeeding Herman Patterson, who recently met death in a railroad accident.

B. T. CUMMINGS, who has been assistant to W. C. Dickey, district manager of sales in the New York office of the Brier Hill Steel Co., Youngstown, Ohio, for the past seven years, has accepted a position as manager of the sheet and tinplate division of J. K. Larkin & Co., New York.

W. S. CHASE, for many years sales manager of the National Acme Co., Cleveland, Ohio, now represents that company in the Pacific Coast states, together with Wyoming, Nevada, Utah and Montana. His office is at 445 Pacific Electric Bldg., Los Angeles. The coast agency will handle the National Acme screw products, automatic screw machines, dies, taps and other products.

NORMAN STRUGNELL, of Clarksburg, W. Va., has been appointed northern West Virginia representative of the Pure Carbon Co. of Wellsville, N. Y., manufacturer of carbon brushes for motors and generators and carbon specialties.

HAYES MCFARLAND has been made vice-president of the Bassick Manufacturing Co., Chicago, manufacturer of "Alemite" high-pressure lubricating systems for automobiles and industrial machinery. He will be director of sales and advertising.

Business Items

The Precision & Thread Grinder Manufacturing Co., Philadelphia, announces that it has concluded arrangements with the following firms to act as its foreign representatives; A. R. Williams Machinery Co., Ltd., Toronto, Can., Williams & Wilson, Ltd., Montreal, Can., Allied Machinery Co. of America for France, Belgium, Switzerland, Italy and Spain, V. Lowener for Norway, Sweden and Denmark, Andrews & George Co. for Japan, M. Mott Engineering Co. for Petrograd and Moscow, Russia, R. S. Stokvis & Sons for Holland and Dutch East Indies, Bohm & Bormann for Berlin, Germany, Bevan & Edward for Melbourne, Australia.

It has been announced by the Canadian Steel Foundries, Ltd., that the Welland plant will be opened at an early date. It has been shut down since 1919.

The Connery Machine & Tool Co. has sold its new building on Fisk Avenue, Springfield, Mass., to the Universal Candy & Chocolate Machinery Co., Inc., which will occupy it for the development of its recently established business. Included in the sale is the building site and a quantity of machinery.

The John W. Russell & Sons Co., Springfield, Mass., suffered severe loss on machinery and patents by a fire which partially destroyed its building in Taylor St., Feb. 28.

The Lawrence-Goodling Co., Inc., Mobile, Ala., has succeeded the company that was formerly operated under the name of J. C. Lawrence. The new company will distribute machinery in the southern field and will maintain a warehouse in Mobile.

The Central Sales Office, Navy Yard, Washington, D. C., announces a sale of Navy surplus drills, reamers, sockets and drifts, on Mar. 30. Bids will be opened at 11 a.m. on that date.

The Penn Metal Co., Boston, has purchased the New England steel rod and bar business of the Midvale-Cambria Steel Co., including all machinery, tools and plant and will henceforth make those products that the Midvale-Cambria has been making in its Boston plant.

The Bridgeport Motor Truck Co., Bridgeport, Conn., has purchased the Liberty Manufacturing Co., Stratford, for approximately $50,000.

Philipp Bros, Inc., announces the removal of its offices to suite 902-906 Woolworth Building, New York.

The Narragansett Machine Co., Providence, R. I., has recently increased its capital stock from $1,500,000 to $2,000,000.

The Chandler & Farquhar Co., machinery dealer, formerly located at 32-38 Federal Street, Boston, Mass., has opened its new establishment at 250-260 Devonshire Street, Boston.

The Wallace Barnes Co., screw machine products, springs, etc., of Bristol, Conn., has purchased the plant of Dunbar Brothers Co., manufacturer of springs, also of Bristol. It is understood the deal involved about $700,000. The Dunbar plant will continue operations as heretofore.

The Charter Gas Engine Co., of Sterling, Ill., announces the purchase of the entire Mietz oil engine business (also known as "Mietz & Weiss") heretofore carried on at 128-138 Mott St. and 430 East 19th St., New York City, by the August Mietz Corp. and the Reliance Oil Engine Corporation. The new company is now moving from New York City to its plant at Sterling, Ill., all of the physical assets comprising the Mietz engine, and in the meantime is filling repair orders from New York City. Several of the personnel of the August Mietz Corporation have been engaged by the new company.

At the annual meeting of the American Hardware Corp. of New Britain, Conn., held this week, assistant secretary George P. Spear and secretary Albert N. Abbe were elected vice-presidents, and George Hildebrandt was elected secretary to succeed Mr. Abbe. Joseph C. Andrews was appointed assistant secretary, succeeding Mr. Spear. Mr. Spear has been with the Corbin Screw Division of the company for the past 18 years; Mr. Abbe has been connected with the P. & F. Corbin Division of the concern for thirty-six years.

The Kirsch Manufacturing Co., of Sturgis, Mich., the largest makers of curtain rods in the world, with an annual production amounting to $2,000,000 annually, has purchased the Barmwell Co., of Jackson, Mich. The Barmwell Company were manufacturers of round curtain rods, exclusively, and Mr. Kirsch announces that the newly acquired factory will be equipped with machinery for the making of low priced rods to be merchandised through the five and ten cent stores.

The Great Northern Railway Co., has ordered 125 tank cars from the Chicago Steel Car Co.

The Pennsylvania Railway Co. during the past six months, has ordered engines and cars costing $57,000,000, and has ordered shop and round house improvements which will aggregate $6,000,000, it was announced before a meeting of the Detroit Board of Commerce, March 11.

The Gibb Instrument Co., Bay City, Mich., manufacturer of electric welding equipment, has opened a sales office in Cleveland, Ohio, at 2104 East Superior Ave., in charge of Mr. W. O. Little.

The Bigelow Co., New Haven, Conn., manufacturer of boilers, tanks, stacks, etc., has been given permission by the State legislature to increase its capital stock from $300,000 to $1,000,000, a portion to be used for expansion.

The Wilton Tool Co., manufacturer of tools and special machinery, with headquarters in Detroit, announce the purchase of a three-story, steel factory building at 5835 Russell St., Detroit. This purchase, which comprises 42,000 square ft. of floorspace, will enable the company to assemble all of its departments under one roof. The new factory, which has a valuation of approximately $255,000, will be equipped with new machinery.

The following officers have been elected by the Rogers-Brown Iron Co., Buffalo, N. Y.: William A. Rogers, chairman of the board; William S. Rogers, president; Hugh Kennedy and C. R. Holzworth, vice-presidents; David G. Williams, treasurer; and Charles H. Byron, secretary.

The Farrell Foundry & Machine Co. of Buffalo reports that it has two and one-half times as many orders on hand now as in January, and that the present business is healthier than it has been at any time in the past two or three years. The chilled roll business is notably fine, indicating increased manufacturing activity in the paint and varnish, chocolate and linseed oil lines.

The National Motors Corporation, organized last August with the merger of eight automobile companies situated in seven different states, will take over a large factory site in Detroit this spring, according to the announcement of Clarence A. Earl, president and general manager. The Detroit plant will constitute the ninth unit of the corporation and will give the National Motors three factories in Michigan. Walter M. Anthony, for eight years treasurer of the Maxwell Motor Co. has been named vice-president and treasurer.

Incorporation papers were filed shortly after the merger under the name of the Associated Motor Industries, but this name was announced changed with the opening of the New York Auto Show, when the new line of National cars made its appearance. The eight factories now operating under the National Motors, Inc., are: National Motor Car Corporation, Indianapolis, Ind.; Jackson Motors Corporation, Jackson, Mich.; Covert Gear Co., Lockport, N. Y.; Traffic Motor Truck Corporation, St. Louis, Mo., Kentucky Wagon Manufacturing Co., Louisville, Ky.; Saginaw Sheet Metal Works, Saginaw, Mich.; Murray-Tregurtha Corporation, Quincy, Mass.; and the Recording and Computing Machine Co., Dayton, Ohio. The home office of the corporation will be located in Detroit, Mr. Anthony announced. The exact location of the site, however, will be announced later, pending the selection of one of four which are now under advisement.

The Illinois Central Railroad Co. has placed contracts for 2,000 automobile cars in an effort to relieve congestion in shipping from Detroit, which congestion has arisen from the unprecedented sale of automobiles since the introduction of new models. Of the lot, 1,000 will be 40 ft., 40 ton, automobile box cars to be built by the American Car and Foundry Co.'s plant at St. Louis. Five hundred cars of the same dimensions will be built at the plant of the Western Steel Car and Foundry Co., at Hammond, Ind., and the balance will be 40 ft., 40 ton, auto-furniture cars to be built by the Mt. Vernon Car and Manufacturing Co., Mt. Vernon, Ill. All of the new cars will be 8 ft. 6 in. wide, 10 ft. high, and will be equipped with 10 ft. staggered doors.

Book Reviews

Capital's Duty to the Wage-Earner. By John Calder, Member A.S.M.E., Member S.I.E. Illustrated, 326 pages, 6x9 in. Published by Longmans, Green & Co., 55 Fifth Ave., New York, N. Y.

Here is a thoughtful treatise on the age-old problem of the relations between capital and labor. The author brings forty years of varied experience in the industrial field to his work, and treats his subject with a breadth of vision and insight into human nature that is unusual.

The book starts with a statement of the labor problem which is backed up by statistics and interpretations and leads up to an analysis of the reasons why men work. Then comes an outline of labor's objections to capitalism, which is followed by a description of labor unionism and the worker's wants. The other side of the case is given in the chapter on employers' associations and the one on the "open" and the "closed shop." The case for the employer is concluded by the chapter on the claims of capitalism. The following chapter brings in the interest of the general public, and then come three chapters on organizing-production, personnel services and economic relationships.

We then come to the heart of the whole matter in the two chapters on employees' representation, which is recommended by the author as the solution of many of the difficult problems in the relations between capital and labor. The relation of capital and labor to working hours, wages, profit-sharing, ownership-sharing and management-sharing occupies three chapters and then come two on unemployment and immigration. The last two chapters on "Social Justice" and the future are particularly good. We have no hesitation in recommending them and, in fact, the whole book to the careful attention of capitalists, employers, managers and labor leaders.

There is an appendix giving details of a plan of employees' representation and the privileges and duties of employees' representatives. A short bibliography and an index complete the volume.

Rapid Arithmetic. By T. O'Conor Sloane, Ph.D., LL.D. First edition, blue cloth-board covers, 190 pages, 5x7½ inches. Published by D. Van Nostrand Co., 8 Warren St., New York, N. Y. Price $1.50.

The work is more or less a supplement to the ordinary textbook on airthmetic, although it includes all the elementary operations that are taught to beginners. But, where the ordinary textbook gives little and scant treatment of a subject with usually only one method of doing an operation, this book gives thorough information on a subject and cites many ways of doing an operation.

In an interesting and instructive way, the volume gives a dozen or more ways of adding, illustrates that there are a number of ways of applying the other three primary rules, and shows that it is quite within the reach of anyone to add up two columns simultaneously. These are only a few illustrations of the type of information contained within the pages. The information has been gathered from a number of sources and authorities. The author claims that the collection set forth in the volume represents the accumulation of the best from many sources. By applying the methods given in the volume a greater command of arithmetical operations should be acquired and quick and advantageous ways of calculating should result.

The book is divided into twelve chapters, of which the first five deal with an explanation of notation and signs and the four fundamental operations of arithmetic. In each case, several methods of working a problem are given and illustrated with numerical examples. Many of them result in time-saving short cuts that are practical in real work.

The other chapters deal with fractions; the decimal point; interest and discount; powers of numbers, exponents; squaring the circle; and miscellaneous facts of interest. These chapters deal with the more advanced arithmetic operations, and as before, all methods are illustrated with numerical examples in each case. Clear conceptions are given on such questions as why any number, great or small, raised to the zero power is equal to one, when it seems as if it ought to be equal to zero, the meaning of the fractional exponent and fractional bar, and what are circular numbers and vulgar fractions.

Index to Proceedings of the American Society for Testing Materials, Volumes XIII to XX. One hundred eighty-nine 6x9 in. pages. Published by the American Society for Testing Materials, 1315 Spruce Street, Philadelphia, Pa. Price $2.50 in cloth binding or $3.50 in half leather binding.

The book is begun by a list of key words of great assistance in using the index. This list is followed by subject and author indexes. The concluding part is a table of contents of the proceedings by individual volumes. The years covered are from 1913 to 1920, inclusive.

Trade Catalogs

Dunning Air Compressors. The Geo. Sachsenmaier Co., 926 North Third St., Philadelphia, Pa., has recently issued a pocket-size, 8-page folder on its line of air compressors. The compressors are illustrated as plain units, motor-driven units, and as complete tank outfits, and they are made in a variety of sizes both for attachment on automobiles and for garage and similar uses.

Portable Timing Devices. The General Electric Co., Schenectady, N. Y., has just issued Bulletin No. 46,053 describing an electrically driven portable timing device. This instrument consists chiefly of an encased clock, to be used with a standardized clock as a means of secondary timing, to replace the stop watch on certain types of work. The four-page bulletin illustrates and describes the mechanism, action and uses of the device.

Salient Facts on Silent Gears. A 20-page pamphlet, 4x7 in., by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., describing the Micarta gears made by that company. It explains in detail the characteristics of Micarta gears and pinions and shows examples of their application. The pamphlet includes a table on horsepower ratings giving the horsepower per inch of face for gears of various pitches based on the pitch-line speed in feet per minute.

Pamphlets Received

The Bureau of Standards of the Department of Commerce has issued No. 2 of its handbook series under the title "National Safety Code for the Protection of the Heads and Eyes of Industrial Workers." The kinds of protectors described include those for chippers, riveters, calkers, grinders, babbitters, handlers of corrosive chemicals, sand blasters, welders, those exposed to glare and those exposed to dust and wind. The pamphlet may be secured from the Superintendent of Documents, Government Printing Office, Washington, D. C., for ten cents per copy.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Machinery for the manufacture of ball bearings — Italy. Purchase. Quotations, c.i.f. Genoa or Turin. Terms: Cash against documents. Reference No. 5628.

Machinery for making tin cans for packing preserved fish and machinery for extracting fish oil and preparing fertilizer from fish—Spain. Purchase. Quotations. c.i.f. Spanish port. Terms: Payment on receipt of goods. Correspondence, Spanish. Reference No. 5629.

Machinery for making buttons for overalls and work clothing, and supplies for button making—Mexico. Purchase. Reference No. 5630.

Stamping machine, capable of punching 8 holes, 18 mm. in dia. steel plates, 8 mm. thick, depth of throat, 400 mm.; and steel plate shearing machine, depth of throat 500 mm., length of plates, 450 mm. for the manufacture of enameled tanks, operated by an a.c. motor, 190 volts, 50 cycles, now in possession of the inquirer—France. Purchase. Quotations, c.i.f. Havre. Correspondence, French. Reference No. 5631.

Machinery for the equipment of plant for the manufacture of cotton waste—Chile. Purchase. Quotations, c.i.f. Chilean port. Terms: Cash against documents, through bank. Reference No. 5632.

Machinery used in connection with the manufacture of round and square wood tanks, and also cask-making machinery—England. Purchase. Quotations, c.i.f. English port. Terms: Cash against documents. Reference No. 5633.

Machinery for the manufacture of barrel staves — France. Purchase and agency. Quotations, c.i.f. French port. Reference No. 5634.

Cotton-textile machinery, especially looms and machines for printing cotton textiles—Paraguay. Purchase. Quotations, c.i.f. Asuncion or Buenos Aires. Correspondence, Spanish. Reference No. 5635.

Tinned mattress wires of 23 gage, upholstered coppered spring wire, fencing and barbed wire, machinists' and other tools—Australia. Agency. Quotations, c.i.f. Australian port. Terms: Cash against documents. Reference No. 5689.

Automobile accessories for small and medium sized cars. Japan. Purchase. Quotations, c.i.f. Japanese port. Terms: payment against document. Reference No. 5737.

Forthcoming Meetings

International Chamber of Commerce. Second general meeting, Rome, March 18 to 24. Julius Barnes, President of the United States Chamber of Commerce will head the American delegation.

National Metal Trades Association. Twenty-fifth annual convention to be held at Hotel Astor, New York City, April 18 and 19. L. W. Fischer, secretary.

Society of Industrial Engineers. Spring convention at Hotel Gibson, Cincinnati, Ohio, April 18 to 20. Secretary, George C. Dent, 327 South La Salle St., Chicago, Ill.

American Gear Manufacturers' Association. Seventh annual meeting April 19, 20 and 21, Hotel Cleveland, Cleveland, Ohio.

National Foreign Trade Council. Annual meeting at the Grunewald Hotel, New Orleans, La., May 2, 3 and 4, 1923. O. K. Davis, Secretary, 1 Hanover Square, New York City.

American Foundrymen's Association. Annual convention, and exhibition at Public Hall, Cleveland, Ohio, April 30 to May 3, 1923. C. E. Hoyt, 140 South Dearborn St., Chicago, is secretary.

American Electro Chemical Society. Semi-annual meeting, Hotel Commodore, New York City, May 3 to 5, 1923. Colin G. Fink, 327 South La Salle St., Chicago, Ill., is secretary.

National Supply and Machinery Dealers' Association; Southern Supply and Machinery Dealers' Association; and the American Supply and Machinery Manufacturers' Association, triple convention, in Cincinnati, Ohio, May 17, 18, 19, 1923. F. D. Mitchell, 1819 Broadway, New York City, is secretary.

American Society of Mechanical Engineers. Spring meeting at Montreal, Can., May 28 to 31. Calvin W. Rice, 29 W. 39th St., New York City.

American Society for Testing Materials. Annual meeting at Atlantic City, June, 1923. C. L. Warwick, 1315 Spruce St., Philadelphia, is secretary.

Society of Automotive Engineers. Summer Meeting. Spring Lake, N. J., June 19 to 23.

American Society for Steel Treating. Eastern sectional meeting, Bethlehem, Pa., June 14 and 15. Hotel reservations through George C. Lilly, Superintendent of Heat Treatment, Bethlehem Steel Co., Bethlehem, Pa.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances—Car material, ship and oil-tank plate requirements continue active, with new inquiries for structural steel improving in volume. Structural shapes at minimum of $2.35 per 100 lb., Pittsburgh; $2.50, on specified deliveries. Plates also at minimum of $2.35, at mill; $2.50@$2.60 having been bid to secure deliveries in thirty to sixty days. Bar mills sold up; minimum of $2.35 quoted on large tonnages, with small lots for quick shipment not under $2.50 per 100 lb. Iron and steel scrap higher. Bessemer pig iron up 23c., basic, 50c. and No. 2 foundry, $1.50 per ton at Pittsburgh. Bar iron 10c. per 100 lb. higher at mill.

Tin prices up to peak level of June, 1920; 52½c. at New York warehouses as against 48¼c. per lb., last week. Zinc market stronger. Aluminum ingots 1c. per lb. higher in New York. Tin plates, bolts, nuts and washers advanced in Cleveland during week. Solder up 1c. in Cleveland and 1¼c. per lb. in New York. Gray iron machinery castings up ¼c. per lb. in Cleveland; slightly higher in New York. Electric welding wire rose 35c. per 100 lb. since last week. Raw linseed oil, $1.04, f.o.b. New York, against $1.01 per gal. (5 bbl. lots) one week ago.

Declines—Lead market easier; down ¼c. in New York and ¼c. per lb., f.o.b. E. St. Louis. Antimony quiet; demand fallen off somewhat, with prices 10c. per 100 lb. lower.

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$30.55
Northern Basic	30.27
Southern Ohio No. 2	32.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	33.44
BIRMINGHAM	
No. 2 Foundry	26.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	31.76
Virginia No. 2	33.17
Basic	29.00
Grey Forge	29.00
CHICAGO	
No. 2 Foundry local	31.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	32.01
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	30.00
Basic	29.00
Bessemer	29.50

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	6.0
Cleveland	5½@6½
Cincinnati	4@6
New York	5½@5¾
Chicago	4@5

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.65@2.90	4.34	3.75	4.15
No. 12	2.75@3.00	4.39	3.80	4.20
No. 14	2.85@3.10	4.44	3.85	4.25
No. 16	3.05@3.30	4.54	3.95	4.35
Black				
Nos. 17 and 21.	3.35@3.60	4.70	4.40	4.85
Nos. 22 and 24.	3.40@3.65	4.75	4.45	4.85
Nos. 25 and 26.	3.45@3.70	4.80	4.50	4.90
No. 28	3.50@3.75	4.90	4.60	5.00
Galvanized				
Nos. 10 and 11.	3.60@3.75	4.90	4.65	4.85
Nos. 12 and 14.	3.70@3.85	5.00	4.75	4.95
Nos. 17 and 21.	4.00@4.15	5.30	5.05	....
Nos. 22 and 24.	4.15@4.30	5.45	5.20	5.40
No. 26	4.30@4.45	5.60	5.45	5.55
No. 28	4.60@4.75	5.90	5.75	5.85

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
		BUTT WELD			
1 to 3	64	52½	⅜ to 1½	30	13
		LAP WELD			
2	57	45½	2	23	7
2½ to 6	61	49½	2½ to 4	26	11
7 to 8	58	45½	4½ to 6	28	13
9 to 12	57	44½	7 to 12	26	11
		BUTT WELD, EXTRA STRONG, PLAIN ENDS			
1 to 1½	62	51½	⅜ to 1½	30	14
2 to 3	63	52½			
		LAP WELD, EXTRA STRONG, PLAIN ENDS			
2	55	44½	2	23	9
2½ to 4	59	48½	2½ to 4	29	15
4½ to 6	58	47½	4½ to 6	28	14
7 to 8	54	41½	7 to 8	21	7
9 to 12	48	35½	9 to 12	16	2

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	54%	41%	55½%	43½%	62½%	48½%
2½ to 6 in. steel lap welded	51%	38%	53½%	40½%	59½%	45½%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 5%. Cast iron, standard sizes, 25% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.10
Hoop steel	4.69	4.51	4.45
Cold rolled strip steel	7.00	8.25	7.25
Floor plates	5.65	5.46	5.65
Cold finished shafting or screw	4.20	3.90	4.10
Cold finished flats, squares	4.70	4.40	4.60
Structural shapes (base)	3.44	3.31	3.20
Soft steel bars (base)	3.34	3.21	3.10
Soft steel bar shapes (base)	3.34	3.21	3.10
Soft steel bands (base)	4.14	3.61	3.85
Tank plates (base)	3.44	3.31	3.20
Bar iron (3.00 at mill)	3.34	2.91	2.92½
Carbon tool steel	11.00	....	....
Drill rod (from list)	55%	40@55%	50%
Electric welding wire:			
⅝	8.50		14.00
¼	7.35		12.25
1/16 to ½	7.10		11.00

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			17.62½
Tin, 5-ton lots, New York			52.50
Lead (up to carlots), St. Louis	8.30;	New York.	9.00
Zinc (up to carlots), St. Louis	8.00;	New York.	8.35

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	26.20	26.00	28.00
Antimony (Chinese), ton spot	10.00	11.50	9.50
Copper sheets, base	25.00	24.50@25.00	23.00
Copper wire (l.c.l.)	19.37½	21.50	16.25
Copper bars (l.c.l.)	23.25	24.75	19.50
Copper tubing (l.c.l.)	27.50	29.75	23.00
Brass sheets (l.c.l.)	21.12½	24.75	18.75
Brass tubing (l.c.l.)	25.50	29.75	20.50

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (carlots)	19.37½	21.75	15.75
Brass wire (carlots)	21.62½	22.00	.....
Zinc sheets (casks)	10.75	11.00	.....
Solder (½ and ½), (caselots)	35.00	31.75@34.75	20.00
Babbitt metal (83% tin)	42.00	60.00	36.00
Babbitt metal (35% tin)	25.00	18.50	.....
Nickel (ingot and shot), Bayonne, N. J.	29.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	32.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel sheet (base)	55
Hot rolled rods, Grade "A" (base)	50
Cold drawn rods, Grade "A" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled rods "E"—low manganese (base)	54
Manganese nickel hot rolled rods "D"—high manganese (base)	57

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	46.00
Hot rolled sheets (base)			45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	14.75@15.25	14.00	15.00
Copper, heavy, and wire	14.50@15.00	13.50	14.25
Copper, light, and bottoms	12.50@13.00	12.00	13.00
Lead, heavy	6.25@ 6.75	6.50	7.00
Lead, tea	5.75@ 6.00	5.00	6.00
Brass, heavy, yellow	8.75@ 9.00	....	9.00
Brass, heavy, red	12.25@12.75	12.00	12.00
Brass, light	7.25@ 7.75	7 50	7.75
No. 1 yellow brass turnings	8.75@ 9.00	8.50	9.00
Zinc	5 00@ 5.50	4.50	5.00

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	22.00	18.25	18.50
IX,	20x28, 112 sheets	24.50	21.00	20.90
"A" Grade:				
IC,	20x28, 112 sheets	19.50	16.00	17.00
IX,	20x28, 112 sheets	22.00	18.75	19.60
Coke Plates, Bright				
Prime, 20x28 in.:				
100-lb.,	112 sheets	13.00	12.20	14.50
IC,	112 sheets	13.30	12.60	14.80
Terne Plate				
Small lots, 8-lb. Coating:				
100-lb.,	14x20	7.00	6.30	7.25
IC,	14x20	7.25	6.55	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.10@0.13	$0.15	$0.11½
Cotton waste, colored, per lb.	.07@.12	.12	.08
Wiping cloths, 13½x13½, per lb.	.16	36.00 per M	.10
Wiping cloths, 13½x20½, per lb.	.20	52.00 per M	.13
Sal soda, 100 lb. lots	2.60	3.50	2.65
Roll sulphur, per 100 lb.	2.65	2.40	3.50
Linseed oil, per gal., 5 bbl. lots	1.04	1.08	1.12
White lead, dry or in oil	100 lb. kegs.	New York, 14.25	
Red lead, dry	100 lb. kegs.	New York, 14 25	
Red lead, in oil	100 lb. kegs.	New York, 15.75	
Fire clay, per 100 lb. bag		.65	.60
Coke, prompt furnace, Connellsville	per net ton	$7.25@7.50	
Coke, prompt foundry, Connellsville	per net ton	8.00	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	40%	50-10%	50%
1½ and 1¼x3 in. up to 12 in.	20%	50%	50%
With cold punched sq. nuts	25%	$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	30%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	15%	3.90 net	.....
Hex. head and hex. nut bolts	20%	.....	65-5%
Lag screws, coach screws	40%	.....	60-5%
Square and hex. head cap screws	70%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in.	30%	45%	45%
Bolt ends, with hot pressed nuts	40%	.....	55%
Tap bolts, hex. head, list plus	20%	.....	.....
Semi-finished nuts ⅜ and larger	60%	65-10%	80%
Case-hardened nuts	50%	.....	.....
Washers, cast iron, ⅜ in., per 100 lb. (net)	$6.00	$4.00	$3.50
Washers, cast iron, ⅜ in., per 100 lb. (net)	4.50	4.00	3.50
Washers, round plate, per 100 lb. Off list	3.00	4.50	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	2.75	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	2.75	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.00	2.75	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.00	2.75	4.00
Rivets:			
Rivets, ⅛ in. dia. and smaller	45%	50-10%	60%
Rivets, tinned	50%	50-10%	4½c. net
Button heads ⅜-in., ½-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.00	$3.90	$3.75
Cone heads, ditto (net)	5.10	4.00	3.85
1½ to 1¾-in. long, all diameters, *EXTRA* per 100 lb	0.25	.....	0.15
⅜ in. diameter *EXTRA*	0.15	.....	0.15
½ in. diameter *EXTRA*	0.50	.....	0.50
1 in. long, and shorter *EXTRA*	0.50	.....	0.50
Longer than 5 in. *EXTRA*	0.25	.....	0.25
Less than 200 lb. *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.35	.....	$3.70 base
Copper rivets	50%	35%	50%
Copper burs	30%	35%	20%

Lard cutting oil (50 gal. bbl.) per gal.	$0.55	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.297	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin. ft., $2.88:			
Medium grade	30-10%	40½%	50%
Heavy grade	20-5-2½%	30-5%	40-5%
Rubber and duck:			
First grade	60%	50-10%	40-10%
Second grade	65%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.,			
No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.84	$5.84	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll.	4.50	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100:			
Paper	1.32	1.24	1.40
Cloth	3.02	2.67	3.20

New and Enlarged Shops

Machine Tools Wanted

Calif., San Francisco—Pratt Bldg. Material Co., Hearst Bldg., C. F. Pratt, Pres.—machine shop equipment, rock crushing machinery, steam shovel and belt conveyors for proposed rock crushing and gravel plant at Folsom City.

Conn., Georgetown — Gilbert & Bennett Co. (manufacturer of wire goods)—several wire forming machines.

Ill., Chicago—Progress Machine Wks., 512-514 North La Salle St., F. H. Husted, Purch. Agt.—automatic die grinder.

Mo., Kansas City—Gill Machine Shop, 203 East 18th St., J. Gill, Purch. Agt.—8 ft. lathe with 18 in. swing on a 16 gap bed.

N. J., Newark—G. W. Heath & Co., 208 1st St. (manufacturer of fountain pens)—Brown & Sharpe screw machine with slotting attachment.

N. Y., Adams Center — S. Dibble Co., Main St. (machine shop, repairs and garage)—light drop hammer for forge shop.

N. Y., Boonville—Lester-Gardner Motor Co. (machine shop, garage and repairs), R. J. Lester, Purch. Agt.—14 in. back geared engine lathe.

N. Y., Buffalo—E. Adleo, 1621 Bway—garage and repair shop equipment, also one 1,000 gal. gasoline tank and pump.

N. Y., Buffalo—B. J. Ambrose, 2129 Fillmore Ave.—service station equipment and one 1,000 gal. gasoline tank and pump.

N. Y., Buffalo—G. J. Bliemeister, 107 Wisconsin St.—machinery, tools and equipment for the manufacture of small 3 way petcocks and carbureter experimental parts.

N. Y., Buffalo—L. Campbell, 107 Forest Ave.—equipment for automobile repair shop.

N. Y., Buffalo—E. J. Goetz, 75 Butler Ave.—equipment and one 1,000 gal. gasoline tank and pump for service station on Tupper and Washington Sts.

N. Y., Buffalo—Kensington Auto Supplies, 919 Kensington Ave., A. H. Carter, Purch. Agt.—equipment for repair shop of proposed garage.

N. Y., Buffalo — J. M. Navadel, 3205 Bailey Ave.—repair equipment for proposed garage.

N. Y., Buffalo—J. A. Sanders, 799 Northampton St.—metal working machinery and equipment for shop on Latnrop St.

N. Y., Buffalo—C. M. Stiner, Fillmore and Kensington Aves.—service station equipment and one 1,000 gal. gasoline tank and pump.

N. Y., Buffalo—H. J. Weber, 469 Dodge St.—equipment for automobile repair shop at 1155 Jefferson Ave.

N. Y., Clinton—Mattoon Motor Sales Co., Inc., (garage and machine shop), E. B. Mattoon, Purch. Agt.—light lathe for general repair shop (new or used).

N. Y., Falconer—M. L. Foster—equipment for new garage and repair shop.

N. Y., Glenpark—E. Jones—complete mechanical equipment, including light metal punches, shears, forming rolls, lathe, drill press and small shop tools, for the manufacture of automatic stereopticons.

N. Y., Harrisville—Diana Paper Co.—pulp stone dresser and floor type radial drill.

N. Y., Natural Bridge — Basic Refractories Co., (stone products)—two 2½ ton chain hoists and arbor press.

N. Y., Natural Bridge—L. Prettie & Co. (forgings, blacksmith and repairs)—400 to 450 lb. drop hammer.

N. Y., Syracuse—Syracuse Washing Machine Corp., Solar and Spencer Sts.—cut-off machine without threading attachment, to cutoff 6 in. steel pipe (used).

N. Y., Theresa—O. P. Eggleston Co. (machine shop)—14 or 16 in. back geared engine lathe.

N. Y., Utica—Miller & Evans Co., Lafayette St. and Bway, (machine shop and garage), H. F. Miller, Purch. Agt.—small engine lathe and drill press for motor repair.

N. Y., Watertown—Eager Electric Co., 522 Newell St. (manufacturer of electrical goods), H. Eager, Purch. Agt.—light sheet metal punch.

N. Y., Watertown—McCaffreys Machine Co., 933 Academy St.—special machinery for re-grinding cylinders.

N. Y., Watertown—Taggart Bros. Paper Co., West Main St., J. Taggart, Purch. Agt.—power operated angle shear.

N. Y., Watertown—J. A. Traynor, 933 Superior St. (contractor)—power operated angle shear.

N. C., High Point—High Point Machine Wks. (machine shop and foundry) — Sturtevant blower (used), small power punch and shear.

O., Columbus—Acme Motor Truck Sales Co., 178 North 4th St., J. W. Baker, Mgr.—machinery for service station, including grinder and shaper.

O., Columbus — Fletcher & Shears, 430 North High St. (welding equipment repairs), F. C. Shears, Mgr.—one small speed lathe.

O., Toledo — Owens Bottle Co., 1401-55 Nicholas Bldg.—bending machine for bending bars.

Ore., Portland—S. W. Koeny Sheet Metal Wks., 273 Couch St.—power punch for sheets up to ¼ in., throat 10 in. or larger, belt driven.

Pa., Pittsburgh—DeRoth Steel Truck & Car Wheel Co., Keystone Bldg. (manufacturer of steel trucks, car wheels and mine supplies), J. DeRoth, Pres.—drill presses, boring mill, lathes and pattern machinery.

R. I., Providence — B. D. Aldrich, 144 Westminster St.—small lathe, planer, drills and small tools for garage (used).

W. Va., Huntington—Motor Sales Co., 1611 6th Ave.—machine shop, garage and repair shop machinery, tools and equipment.

Wis., Grafton—Robel & Showalter—power and automobile repair machinery for proposed garage at Port Washington.

Wis., Mayville — Bachhuler Bros., (machinists), M. J. Bachhuler, Purch. Agt.—heavy duty lathe, drill press and emery wheels.

Wis., Phillips—G. J. Goetsch—automobile repair machinery, including press, for proposed garage.

Ont., Galt—R. Fowlie, Dixon St.—complete garage and repair shop equipment (new).

Ont., Hyde Park—R. E. Morris—complete equipment for $40,000 garage, service station and repair shop.

Machinery Wanted

Ala., Birmingham — G. R. Mueller Co., Brown-Marx Bldg. (machinery, contractors, engineers, etc.)—locomotive crane, 15 to 20 ton capacity, 8 wheel, 40 to 50 ft. boom.

Calif., Oakdale—Atlas Rock Co., A. C. McMillan, Pres.—$20,000 worth of rock crushers and equipment for the manufacture of cement pipe.

Ga., Rossville—Peerless Woolen Mills—carding and dyeing equipment for proposed addition to mill.

Ill., Chicago—Rehberger Mfg. Co., 2159 Lewis St., (job printers)—one Miller Universal saw and trimmer for power equipment.

Ill., Chicago—Wanner Mchy. Co., 714-716 Dearborn St. (printers' machinery)—18 x 25 Scott drum press.

Ill., Waukegan—Bd. Educ., J. Reardorn, Secy.—manual training machinery, including turning lathes, saws and benches.

Ind., Laporte — Bastian & Morley Co. (manufacturer of gas water heaters)—machinery and equipment for new plant at Conshohocken, Pa.

Ind., Warsaw—Braude-Pierce Furniture Co.—woodworking machinery and equipment for 2 story addition to factory.

Kan., Esbon—E. Vaughn (newspaper and job printer)—diamond cylinder press.

Kan., Herndon—Northwestern Mercantile Co.—9 x 13 in. power job printing press.

Ky., Paducah—Tucker Chemical Mfg. Co., manufacturer of textile chemicals), E. C. Pace, Purch. Agt.—machinery and equipment for plant.

Ky., Pineville—Liberty Coal & Coke Co., R. A. Atkins, Pres.—machinery and equipment for the development of extensive coal lands.

Md., Baltimore—Baltimore Ice Mfg. Co., c/o A. Beard, Pres., Hopkins Apartment—ice making machinery, 125 ton daily capacity.

Mass., Beverly—Bd. Educ.—machinery, including saws, tables, planers, lathes, etc., for vocational department of new high school.

Mass., Deerfield—School Com.—soon receiving bids for woodworking machinery, including lathe, planer, matcher, saws and tables, for proposed school.

Mass., East Braintree (Boston P. O.)—East Braintree Bleachers—bleachery equipment.

Mass., Lynn — Schoolhouse Dept., Division of Public Wks.—vocational equipment, including lathes, planers, saws, tables, matchers, etc., for Massachusetts Eastern Junior High School.

Mass., Weymouth—Bd. Educ.—machinery, including saws, tables, planers, matchers, sanders, etc., for vocational department of high school.

Mass., Worcester—Standard Paper Goods Mfg. Co., 26 Southbridge St., address Purchasing Agent—one 10 x 15 in. angle frame Kidder printing press (used).

Mich., Detroit — Aubin Terminals Corp., 707 Free Press Bldg.—conveying equipment for proposed $3,000,000 warehouse.

Mich., Detroit—Consolidated Stamping & Mfg. Co., 4847 Woodward St., R. T. Carr, Pres.—equipment for factory for the manufacture of dolls, toys and nursery furniture at Sarnia, Ont.

Mich., Grand Rapids—Adzit Printers, 41 Ellsworth Ave., S. W.—2 color job printing press.

Mich., St. Joseph—J. T. Townsend—laundry machinery, including power washers, mangles and driers.

Miss., Poplarville—Love Lumber Co.—sawmill, planing and lumber mill machinery and equipment.

Miss., Wiggins—Finkbine Lumber Co.—machinery and equipment for proposed lumber mill, 125,000 ft. daily capacity.

Neb., Benkelman—Bd. Educ.—vocational equipment for $100,000 school.

Neb., Homer—The Index—7 column, cylinder newspaper press.

N. Y., Arcade—Bd. Educ.—vocational equipment for $200,000 school.

N. Y., Batavia — Gipsolite Co., Inc., (manufacturer of building board products), J. F. Haggerty, Pres.—machinery and equipment to double present capacity of plant.

N. Y., Binghamton—Larrabee-Deyo Motor Truck Corp., 23 Washington St., E. Maceym, Vice Pres.—machinery and equipment for motor truck factory addition, 50,000 sq. ft.

N. Y., Binghamton—Vail-Ballou Co., Jarvis St.—special machinery and equipment for book binding.

N. Y., Brockton—Naboth Grape Juice Co., c/o D. Wright—machinery and equipment for the manufacture of grape juice, to replace that which was destroyed by fire.

N. Y., Brooklyn—H. Copeland, 53 Chauncey St.—woodworking machinery, including bandsaw, sander, saw table, etc.

N. Y., Buffalo—F. J. Dottrel, 2614 Main St.—candy making machinery.

N. Y., Buffalo—Fedders Mfg. Co., 57 Tonawanda St., J. M. Fedders, Purch. Agt. —machinery for the manufacture of automobile radiators for new factory.

N. Y., Buffalo—Montgomery Bros. Co., 254 Court St., (woodworking and lumber)—dry kiln machinery and equipment.

N. Y., Buffalo—Queen City Development Co., Inc., Delaware Ave., J. R. Booker, Pres.—bandsaws, electrically operated.

N. Y., Buffalo—H. Radtke, 975 Genesee St.—machinery and equipment for furniture repair shop.

N. Y., Buffalo—W. Slater, 1429 Fillmore Ave.—machinery for the manufacture of corn crispettes.

N. Y., Cape Vincent—Raymond & Stratford (machine repairs, etc.)—forge castings for built in forge with electrically driven blower.

N. Y., Gouverneur—International Talc Co.—power operated pulverizing drums.

N. Y., Gouverneur—G. C. Washburn Co., Hailesboro St. (repair shop)—bandsaw for pattern making.

N. Y., Holley—Holley Cold Storage Co.—machinery and equipment for large addition to cold storage plant.

N. Y., Jamestown—Ahlstrom Piano Co., 112 East 2nd St., C. K. Ahlstrom, Dir.—machinery and equipment for the manufacture of furniture.

N. Y., Jamestown—Jamestown Worsted Mills, Inc., 335 Harrison St.—textile machinery and looms for new 3 story addition to mill.

N. Y., Jamestown—Quality Cash Stores, Inc., 53 River St. (wholesale food stuffs)—mechanical warehouse equipment, including conveying and handling machinery and equipment.

N. Y., Johnsonville—L. B. Brockett Lumber Co.—heavy duty crosscut saw with frame and table.

N. Y., Lockport—W. O. Keiter—machinery for the manufacture of powder puffs and novelties.

N. Y., Lyonsdale—Moyer & Pratt, (manufacture of paper), J. W. Moyer, Lyons Falls, Purch. Agt.—paper cutting machinery.

N. Y., Massena—W. L. Pratt Lumber Co (lumber and planing mill) — bandsaw frame and table, also double surface planer.

N. Y., Nunda—Peck & Pratt, Inc. (condensery)—complete ammonia cold storage system.

N. Y., Sacket Harbor — B. J. Scroxton (tinning, steam fittings, etc.)—sheet metal forming rolls with motor drive and air compressor with tank.

N. Y., Sacket Harbor — Weaver Machine Co., W. H. Weaver, Purch. Agt.—key seater.

N. Y., Sandy Creek—J. Mosier Co. (lumber and sawmill)—heavy duty swing cutoff saw.

N. Y., Suffern—T. Williams—24 x 32 in. or 25 x 28 in. newspaper press.

N. Y., Utica—Fonda Containers Co., Inc., 2150 Erie St., T. S. Foster, Purch. Agt.—automatic folders for the manufacture of pasteboard boxes.

N. Y., Utica—H. Nusbaun Co., 408 Jay St. (welding, springwork, etc.)—power operated metal saw up to 6 in.

N. Y., Watertown—H. W. Bell Co., King St., rear of City Hall, (machine and forge shop)—annealing furnace.

N. Y., Watertown — G. Forrester Co., Court St. (brazing, forging and welding)—heavy duty oxy-acetylene welding outfit.

N. Y., Windsor—G. H. Manwarren, (lumber)—heavy duty circular crosscut saw with frame and table.

N. C., Belhaven—Interstate Co-operative Co.—woodworking machinery and equipment, to replace that which was destroyed by fire.

N. C., Biltmore—William-Brownell Lumber Co.—machinery and equipment for lumber mill, to replace that which was destroyed by fire.

N. C., Hickory—Bd. Educ.—vocational equipment for $150,000 school.

N. D., Fargo—Fargo Laundry Co. and Hegge Bros.—machinery and equipment for proposed laundry.

O., Columbus — Hall-Elder-Hendry Co., 118 Yale Ave. (iron castings), A. L. Hendry, Purch. Agt.—several molding machines for bench work and one sand blast machine.

O., Fremont—Crescent Mfg. Co. (manufacturer of razor blades)—machinery and equipment for addition to plant.

Okla., Ardmore—Colvert Ice Co., Inc.—refrigeration machinery and equipment for proposed ice plant.

Okla., Pawnee—W. F. Toler—machinery and equipment for handling shavings, including blower fans, etc.

Ore., Portland—Pacific Fruit & Produce Co., East 2nd and Alder St., G. Grouell, Pres.—refrigeration machinery for fruit storage.

Pa., Allentown—J. L. Lordan—cold storage and refrigeration equipment for perishable department of proposed warehouse.

Pa., Blossburg—Aracoma Textile Co., c/o Chamber of Commerce, W. T. Roberts, Pres.—textile and silk mill machinery and equipment.

Pa., Bowmansville—Aluminum Pigment & Products Co., Inc., W. H. Trexler, Secy.—pulleys, shafting, pipe, water pumps and belting for proposed crusher and pulverizer buildings.

Pa., Bradford — Bd. Educ. — vocational equipment for proposed $280,000 Junior High School.

Pa., Broomall — Bd. Educ. — vocational equipment for $150,000 school.

Pa., Macungie—East Penn Fdry. Co.—foundry equipment, including cleaning machinery, etc.

Pa., McKees Rocks—Federal Enameling & Stamping Co.—enameling equipment, to replace that which was destroyed by $250,000 fire.

Pa., McKees Rocks—W. L. Singer Ice Co. —ice manufacturing machinery and equipment, to replace that which was destroyed by fire.

Pa., Monongahela—Bd. Educ.—vocational equipment for $175,000 high school.

Pa., Montgomery — Stokes Mfg. Co. — woodworking machinery and equipment for proposed furniture factory.

Pa., Parnassus—Bd. Educ.—vocational equipment for $150,000 school.

Pa., Pittsburgh—Natl. Cement Block Co., 644 Preble Ave.—conveyors.

Pa., Scranton—A. R. C. Radiator Corp., c/o G. W. Thomas, Pres., 370 North Hyde Park Ave.—machinery and equipment for large plant for the manufacture of radiators.

Pa., Sunbury—J. M. Ford Co.—$20,000 worth of forge shop equipment and finishing machinery.

Pa., Warren—Nypenn Furniture Co.—woodworking machinery to replace that which was destroyed by fire.

Pa., Warren—Wetmore-Henderson Lumber Co.—machinery and equipment for the manufacture of cinder concrete building blocks.

Pa., West Nanticoke—Grand Tunnel Coal Co.—coal receiving machinery and equipment, to replace that which was destroyed by fire.

R. I., Pawtucket—D. Goff & Sons, Inc., 29 River St. (yarns, dress goods, etc.), address Purchasing Dept.—one 40 in. and one 80 in. skeleton dresser creel, reel and beamer machines (used).

S. C., Cheraw—J. L. Anderson—veneer mill machinery and equipment.

S. C., Pamplico—Wagoner Lumber Co.—machinery and equipment for lumber mill, to replace that which was destroyed by fire.

S. D., Brookings—H. Thygesen, 517 3rd Ave.—molding machine for concrete park benches.

Tenn., Chattanooga—Magnolia Silk Mills, Georgia Ave. — machinery for new silk thread plant, capacity 1,000 lb. per week.

Tenn., Martin — Weekly County Press — 22 x 30 in., 2 revolution pony newspaper press.

Tenn., Obion—Obion County Enterprise —19 to 30 in. perforator and punching machine.

Tex., Chillicothe — News — job printing equipment.

Tex., Dallas—G. H. Bogue, 1513 Corsicana St. (oil producer)—500 gal. gasoline tank and 5 gal. pump.

Va., Culpeper—Culpeper Creamery Co.—machinery for dairy.

Va., Manquin—J. L. Townsend—hand woodworking machinery (new and used).

Wash., South Bend—Journal—newspaper equipment.

W. Va., Parkersburg—Citizens' Lumber Co.—machinery and equipment for proposed brick plant, 75,000 capacity.

Wis., Appleton—R. H. Pfund, 653 Lincoln St.—traveling crane, about 5 ton.

Wis., Kenosha—Frost Mfg. Co., Fremont Ave.—two electric traveling cranes for proposed foundry.

Wis., Manitowoc — Manitowoc Public Utilities Comn., City Hall, W. C. Staeffler, Secy.—coal and ash handling equipment with crusher, conveyors and hoppers.

Wis., Manitowoc—Wisconsin Pea Canners Co., 6th and Franklin Sts., H. L. Wedertz, Mgr.—power and pea canning machinery, also box conveyors, etc. for proposed canning factory at Plainview.

Wis., Milwaukee—P. Behling, 650 Howell Ave., (carpentry and woodwork)—portable rip and crosscut sawing machine to rip material up to 3 in.

Wis., Milwaukee—Everwear Hosiery Co., 382 10th St., C. C. Smith, Pres.—power forming machines.

Wis., Milwaukee — Fried-Ostermann Co., 623 Reed St., (manufacturer of gloves and mittens)—special machinery for proposed factory.

Wis., Milwaukee—W. Matzke, 1011 Mineral St.—printing presses, paper cutter and proof machine.

Wis., Milwaukee—H. Rediske, 482 24th Ave. (carpentry and woodwork)—12 in. jointer.

Wis., Milwaukee—Wisconsin Magneto Co., 528 Milwaukee St.—machinery and motors for battery repairing and charging.

Wis., Plymouth—P. Welling (woodwork) —medium size planer.

Wis., Racine—Crescent Material Co., c/o W. H. Miller, 468 College Ave.—power machinery, bucket conveyors, etc. for proposed gravel plant.

Wis., Sheboygan—St. Nicholas Hospital Assn., c/o Sister Superior, 9th St. and Huron Ave.—refrigeration machinery for proposed hospital.

Wis., Waukesha—R. O. Compton, 1702 White Rock Ave.—large air compressor.

Wis., West Allis—Sells Printing Co., 6320 Greenfield Ave.—additional presses for proposed print shop.

Ont., Almonte—W. Thoburn (textiles)—Crompton & Knowles looms, 112 in., 21 harness, with cones and boxes (used).

Ont., Caledonia—Caledonia Dairy, Ltd.—equipment for proposed branch dairy and ice cream plant at Jarvis.

Ont., Eganville — E. C. Childerhouse — complete equipment for woolen mill at Campbell's Bay, Que.

Ont., London—Teasdall Hosiery Mills, Ridout St.—complete special machinery for proposed plant for the manufacture of underwear and woolen clothing.

Ont., Point Edward — Sarnia Cement Products Co., A. McGhee, Mgr.—machinery. to replace that which was destroyed by fire Fire loss $30,000.

Que., Makamik—P. Bousneault—drilling outfit for mine in Dester Twp.

Que., Montreal—Canadian Pacific R.R., Windsor Sta., C. E. Fairbairn, Ch. Engr.—280 ton mechanical coaling plant at Ignace, Ont.

Que., St. Alexis des Monts—A. Lemay (lumber, etc.), B. Lemay, Purch. Agt.—14 to 16 in. bars planer, 18 to 20 in. pony planer, small saw, two piercing machines for wood and iron, 1½ in. x 25 ft. shaft, pulleys, straps, etc.

Sask., Regina—Saskatchewan Co-operative Elevator Co.—conveying and grain handling equipment for proposed elevator at Port Arthur, Ont.

Metal Working Shops

Calif., San Francisco—The city and San Francisco Co. are having plans prepared for the construction of car repair shops on a 280 x 400 ft. site on block bounded by Marinosa, 17th, York and Bryant Sts. M. M. O'Shaughnessy, City Hall, engr.

Calif., San Francisco—H. C. Wood, 166 King St., awarded the contract for the construction of a 1 story machine shop on Stillman St. Estimated cost $9,000. Noted March 8.

Conn., Bridgeport—Lockwood, Greene & Co., Engrs. and Archts., 101 Park Ave., New York City, will receive bids until March 30 for the construction of a factory for the manufacture of valves for Jenkins Bros., 510 Main St., here. Estimated cost $250,000. Noted Nov. 23.

Conn., Georgetown—The Gilbert & Bennett Mfg. Co. will soon award the contract for the construction of a 3 story, 50 x 135 ft. addition to its factory for the manufacture of wire. Estimated cost $100,000. Greenwood & Noerr, 847 Main St., Hartford, Engrs. and Archts.

Conn., Middletown—M. Poliner awarded the contract for the construction of a 1 story, 50 x 100 ft. garage in the rear of the Ideal Hotel. Estimated cost $17,000.

Ind., Indianapolis—The Chandler & Taylor Co., 205 South Addison St., plans to rebuild its foundry, which was destroyed by fire. Estimated cost $150,000.

Ia., Des Moines—The Eagle Iron Wks., Court and S. E. 3rd Sts., is having plans prepared for the construction of a 2 story, 80 x 280 ft. factory. Estimated cost $100,000. W. B. Holtzman, Jr., 406 Flynn Bldg., Des Moines, Archt.

Ky., Central City—The J. Barnes Auto Co. is having plans prepared for the construction of a 1 story, 70 x 165 ft. garage. Estimated cost $40,000. Marr & Holman, Stahlman Bldg., Nashville, Tenn., Archts.

Mass., South Boston (Boston P. O.)—The Gillette Safety Razor Co., 41 West 1st St., is having plans prepared for the construction of an 8 story, 80 x 100 ft. addition to its plant. Estimated cost $200,000. C. T. Main, 48 Federal St., Boston, Archt. Noted Dec. 28.

Mass., Worcester — The Crompton & Knowles Loom Wks., 93 Grand St., awarded the contract for the construction of a 1 story, 80 x 100 ft. addition to its forge plant on Tainter St. Estimated cost $25,000.

Mich., Jackson—The Amer. Gear & Mfg. Co. awarded the contract for alterations and additions to its plant, including loading docks and 75 x 125 ft. heat treating building.

Mo., Kansas City—The Bushe & Klapmeyer Ford Sales Co., 2800 East 31st St., is receiving bids for the construction of a 2 story, 50 x 113 ft. garage and sales room on 30th and Prospect Sts. Estimated cost $40,000. R. E. Peden & Co., 945 New York Life Bldg., Kansas City, Archts.

Mo., St. Louis—The Laclede Gas Light Co., Laclede Gas Light Bldg., awarded the contract for the construction of a 1 and 2 story, 100 x 175 ft. garage and shop building on Forest Park Blvd. Estimated cost $50,000. Noted March 8.

N. J., Camden—The Warren Webster Co., Pearl St., awarded the contract for the construction of a 2 story, 180 x 340 ft. factory for the manufacture of heating specialties. Estimated cost $75,000.

N. Y., Buffalo — J. M. Navadel, 3205 Bailey Ave., plans to build a 2 story, 35 x 102 ft. garage and service station. Cost will exceed $40,000. Engineer or architect not announced.

N. Y., New York—The F. L. Smithe Machine Co., 11th Ave. and 21st St., awarded the contract for the construction of a 5 story, 127 x 215 ft. machine shop on 12th Ave. and 44th St.

N. Y., Schenectady—The General Electric Co., River Rd., plans to build a 1 story, 60 x 425 ft. addition to Building 60 for turbine shops and offices. Estimated cost $75,000.

N. Y., Watertown—Taggart Bros. Paper Co., West Main St., plans to build an 80 x 100 ft. machine and carpenter shop addition to its plant. Estimated cost $30,000. J. Amos, Mgr.

O., Cincinnati—The Cincinnati Galvanizing Co., McMicken Ave., awarded the contract for the construction of a 1 story factory to contain 80,000 sq.ft. of floor space, on Springdale and Chipewa Aves. Estimated cost $200,000.

O., Cleveland—M. H. Foote, 1571 Columbus Rd., manufacturer of foundry supplies, awarded the contract for the construction of a 2 story, 42 x 110 ft. factory on East 140th St. north of St. Clair Ave. Estimated cost $50,000.

O., Cleveland—M. E. Kanter, 444 East 124th St., (metal stampings), has had plans prepared for the construction of a 1 story, 72 x 120 ft. factory at 2067 West 55th St. Estimated cost $25,000. Private plans.

O., Cleveland—The Natl. Malleable Castings Co., c/o R. Ewing, Constr. Engr., Quincy Ave. and Woodhill Rd., has had plans prepared for the construction of a 3 story, 60 x 105 ft. pattern building. Estimated cost $75,000. Private plans.

O., Cleveland—The F. B. Stearns Co., Euclid Ave. and Lakeview Rd., manufacturer of automobiles, awarded the contract for the construction of a 2 story, 220 x 300 ft. factory and enameling plant on Euclid Ave. along tracks of New York, Chicago and St. Louis R.R. Estimated cost $300,000. G. W. Booker, Pres.

Pa., Hatboro—The Roberts & Manders Stove Co., 11th and Washington Sts., Phila., awarded the contract for the construction of a 3 story, 60 x 200 ft. and 2 story, 40 x 150 ft. foundry, machine shop and factory, here. Estimated cost $175,000. Noted March 8.

Pa., Meadville—The Bronze Metal Co. is receiving bids for the construction of a 1 story factory. Estimated cost $40,000. Private plans.

Every one of these items is reported by our authorized correspondents who are instructed to verify every item sent in. This free weekly service is published in the interests of the buyer and the seller, to bring them together and get machinery moving.

Everything possible is done to insure authenticity and timeliness.

Your co-operation is invited in helping us maintain this service at the highest efficiency.

BUSINESS NEWS DEPARTMENT
Tenth Ave. at 36th St., New York

Pa., Phila.—The Bureau of Highways, City Hall, awarded the contract for the construction of an office and blacksmith shop on 26th St. and Glenwood Ave. Estimated cost $59,900.

Pa., Phila.—D. and M. Markovitz, c/o Carson & Carson, Archts., 2220 15th St., awarded the contract for the construction of a 4 story, 62 x 106 ft. garage at 1214-20 Filbert St. Estimated cost $200,000.

Pa., Pittsburgh—J. S. Long, Archt., Citizens Savings Bldg., is receiving bids for the construction of a 3 story, 54 x 110 ft. garage on Webster Ave. for the Webster Ave. Garage Co., c/o Architect. Estimated cost $40,000.

Pa., Pittsburgh—H. Posner, c/o Alpha Sign Co., 231 Spahr St., plans to build a 4 story, 100 x 138 ft. garage, etc. on Baum Blvd. and Neville St. Estimated cost $150,000. Engineer or architect not selected.

Pa., Sharon—The Woodside Garage, 712 Spearman Ave., plans to build a 2 story garage. Estimated cost $40,000. Engineer or architect not announced.

Pa., Verona—The Pittsburgh Wire Rope Co. plans to build a 1 story, 120 x 150 ft. plant. Estimated cost $150,000. Engineer or architect not selected.

Pa., Wilkinsburg (Pittsburgh P. O.)—C. C. McKallip, Magee Bldg., Pittsburgh, awarded the contract for the construction of a 1 story, 100 x 140 ft. garage on Penn Ave., here. Estimated cost $40,000. Noted Dec. 21.

R. I., Providence—D. Bellilove, Aborn St., is having plans prepared for the construction of a 1 story, 50 x 150 ft. garage, repair and service station. Estimated cost $40,000. Private plans.

R. I., Providence—S. Bomes, 60 Dorrance St., is having plans prepared for the construction of a 1 story, 100 x 100 ft. garage and service station on Warrenton St. and Elmwood Ave. Estimated cost $40,000. G. H. Wolf, 308 Caesar Misch Bldg., Providence, Archt.

R. I., Providence—G. Gush, 218 Sackett St., plans to build a 1 story, 95 x 100 ft. garage with service station and repair departments, on Elmwood Ave. and Warrenton St. Estimated cost $45,000. Engineer or architect not announced.

R. I., Providence—F. D. McKendall, c/o B. S. D. Martin, Archt., 86 Weybosset St., is having plans prepared for the construction of a 2 story, 75 x 100 ft. garage and service station on Elmwood Ave. Estimated cost $50,000.

R. I., Providence—M. W. Norton, Dorrance St. Garage, will soon award the contract for the construction of a 3 story, addition to garage, 150 car capacity. Estimated cost $75,000. W. R. Walker & Son, 49 Weybosset St., Providence, Archts.

R. I. Providence—J. Trambukis, c/o B. S. D. Martin, Archt., 86 Weybosset St., is having plans prepared for the construction of a 1 story, 60 x 110 ft. garage and service station on Delaine St. and Manton Ave. Estimated cost $40,000.

Tex., Dallas—The Dallas Gas Co., 2016 Jackson St., awarded the contract for the construction of a 1 story, 50 x 400 ft. garage and shop building on Logan St. Estimated cost $60,000. Noted Dec. 28.

Tex., Houston—J. Finger, Archt., Woolworth Bldg., will soon receive bids for the construction of a 3 story factory for rebuilding typewriters, on San Jacinto St. for the Houston Typewriter Exch., 408 Fanning St. Estimated cost $60,000.

W. Va., Huntington — The Motor Sales Co., 1611 6th Ave., will soon receive bids for the construction of a 6 story, 90 x 100 ft. garage on 6th Ave. and 12th St. Estimated cost $200,000. Meanor & Handloser, Robson & Pritchard Bldg., Huntington, Archts.

W. Va., Wheeling—The McGraw Co., 1000 Main St., is having plans prepared for the construction of a 2 story, 85 x 125 ft. Ford service station at 2011 Main St. Estimated cost $40,000. F. F. Faris, Wheeling Steel Bldg., Wheeling, Archt. Noted Aug. 3.

Wis., Kenosha—The Frost Mfg. Co., Fremont Ave., will build a 1 story, 60 x 100 ft. addition to its foundry. Estimated cost $45,000.

Wis., Madison—L. F. Schoelkopf, 210 East Washington Ave., is having plans prepared for the construction of a 1 story, 66 x 150 ft. garage and service station. Estimated cost $40,000. J. R. & E. J. Law, 1st Central Bldg., Madison, Archts. Noted Dec. 28.

Wis., Madison—E. Tough, Archt., Conklin Bldg., is receiving bids for the construction of a 2 story, 36 x 70 ft. store and tire service station for J. E. Teckemeyer, 807 University Ave. Estimated cost $40,000. Noted March 15.

Wis., Milwaukee—The Pawling & Harnischfeger Co., 38th St. and National Ave., awarded the contract for the construction of a 1 story, 100 x 350 ft. machine shop. Estimated cost $150,000.

Wis., Milwaukee—E. A. Swendson, 714 National Ave., awarded the contract for the construction of a 1 story, 150 x 200 ft. garage. Estimated cost $75,000. Noted Feb. 8.

Wis., Milwaukee—The Wisconsin Magneto Co., 528 Milwaukee St., will soon award the contract for the construction of a 1 story, 90 x 122 ft. battery service station on Van Buren St. Estimated cost $45,000. Leiser & Holst, 105 Wells St., Archts.

Wis., Phillips—G. J. Goetsch is having plans prepared for the construction of a 2 story, 60 x 80 ft. garage and repair shop. Estimated cost $40,000. Private plans.

T. H., Honolulu—The Amer. Can Co., Mills Bldg., San Francisco, Calif., will build a 4 story addition to its can plant, here. Cost will exceed $150,000.